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THE BUFFALO-NIAGARA FRANCHISE.

The committee of Councils, charged with the formulation of conditions under which current from Niagara may be introduced within the limits of the city of Buffalo, seems, if we are to judge from its recent action reported in our columns last week, to have considered discretion the better part of valor. After wasting months of valuable time, its former position with respect to the terms to be offered was ingloriously surrendered, and an amended franchise prepared presumably embodying the entire wishes of the Niagara Company. In this, however, it now appears that the committee was mistaken, for still another concession is demanded by the latter—a reduction of the recompense to the city for the franchise from five to two and a half per cent. of gross receipts. The opinion is frequently heard expressed that the Niagara Company is primarily a land-jobbing concern, its prospective profits not lying in the sale of electrical power, but to be realized from rentals and land leases. If this is true, it would not be advantageous for the company to supply power to Buffalo on terms that would result in diverting manufacturing concerns from the vicinity of Niagara, and its action with respect to the Buffalo franchise will probably be accepted by some as confirmation of the above view. However this may be, the city of Buffalo, unless misrepresented by its committee having the matter in charge, deserves little sympathy in its present humiliating plight; for at the commencement of negotiations, when it was thought the Niagara Company was at the mercy of the municipality, even less consideration was shown by the latter than it is now receiving.

PATENT OFFICE RULES.

In April of the present year Commissioner Seymour, of the Patent Office, issued a rule reducing from two years to six months the time allowed an inventor to consider any rejection of his application for a patent before amending the same, and on the 15th of the present month the first period will expire. As there is some doubt as to the right of the Commissioner to place such a construction upon the statute governing the point, it is quite probable that the new rule will be the subject of litigation, and it is most sincerely to be hoped that it will be sustained. In the opinion of the Circuit Court of Appeals in the Berliner case, attention was called to the fact that Congress had been petitioned for years by the Patent Office to reduce the two years' period, but without success. This indifference of Congress was little less than scandalous in view of the public interests at stake, and was directly responsible for keeping back the issue of the Berliner, Edison and other monopolistic patents. Should there be any litigation with respect to the new rule, it may, if we are to judge from the record of the past in suits affecting patents, likely be prolonged over a considerable period, and therefore Congress should at its earliest opportunity atone for past neglect by revising Statute 4,894, and thus leave nothing for the courts to act upon. While in isolated cases it may happen that interferences will naturally take more than six months' time to consider, on the other hand, it is most unjust to make the public subject to a law that will cause injustice to it in perhaps scores of cases, to one where it would perform a good purpose. The general public, however, is not alone affected, for the inventor of improvements on a delayed patent cannot enter into their direct enjoyment until the expiration of the master patent, which expiration may, as would be

the case in many instances if the Berliner patent is sustained, be subsequent to the life of the subsidiary patent. As a consequence, a delay in a patent may result in placing, for a greater or less number of years, at the mercy of the owners of that patent, meritorious patentees of improvements, or they may be ignored entirely—both inventor and public in this case being victims. A grant of a patent in any case contains an element of injustice through the domination involved during its life over the inventions, however valuable, of others on the same subject matter; and this injustice should be minimized instead of being permitted to increase the power of holders of important patents who, besides, are rarely the ones for whose enjoyment the patent monopoly was instituted.

ELECTRICITY IN THE ITALIAN NAVY.

In this issue we print the first part of an extensive article on the Italian navy which will form a contribution of much importance to marine electrical engineering. Owing to the fact that her language, unlike that of France and Germany, is but little known in this country, the high standing of Italy in the sciences and arts suffers in estimation with her great continental neighbors. The names of Galvani and Volta, of Paccinotti and Ferraris, may, however, be cited as sufficient evidence of her high place in electrical science; and, as concerns practical applications, it is only necessary to recall that Milan can boast of the first large incandescent lighting station of the world, and that electrical transmission of power received almost its first practical demonstration on an extensive scale at Tivoli and Genoa. It is therefore not surprising that Italy should also be awarded the credit of being the first nation to reduce the application of electricity on naval vessels to a basis satisfactory both from a purely engineering standpoint and with respect to the very special conditions encountered aboard men-of-war. The conditions which apply to electrical machinery for use on shipboard are severe and often contradictory; the space occupied should be a minimum, yet no complication must thereby be introduced; weights must be kept down, but efficiency and simplicity in management cannot suffer in consequence. In other words, the requirements are such as usually demand a higher grade of skill in handling machinery, yet satisfactory results are demanded with attendants possessing but a modicum of skill. That the problem has been so satisfactorily solved in the Italian navy is very creditable to its electrical engineering department and to the higher naval authorities in supporting a policy which has produced such good results.

A FATAL FLY-WHEEL ACCIDENT.

The fly-wheel accident at Hoboken, last week, which resulted in the death of the engineer on duty, again calls attention to the great element of danger in power-houses from the effects of short circuits. The real cause of the accident may, perhaps, never be known, but one hypothesis is offered by the electrical engineer of the station, and another may be found in the letter of Mr. Coykendall which led to an extended discussion in our columns last year on fly-wheel accidents. According to the first, the engineer, when he found the speed of the engine reduced after a short circuit, manipulated the engine governor to admit more steam to the cylinders, and, a short circuit again occurring, the wheel was given an excessive speed and burst; it seems, however, little probable, that an intelligent man would be so injudicious as to do an act so manifestly wrong. On the other hand, according to the hypothesis of Mr. Coykendall the accident may have occurred through the stress brought upon the wheel by the load being again suddenly applied after a short circuit. While it is said that fly-wheel accidents do not occur in larger proportion in power-houses than elsewhere, yet a cause leading to them is there present, and one which should receive consideration. The most obvious remedy is a design of wheel, such as the Mannesmann or Sharp type, that will safely stand an abnormal speed, but another presents itself that will obviate danger with the present types of wheels, though, perhaps, in some cases, not simple of application. We refer to a modification of the system in use in the Canadian Niagara power-house, and at Ottawa, whereby in case of a short circuit the load may be diverted to resistances, the resulting heat being absorbed by surrounding water. Should this method be generally practicable, its adoption would be advisable aside from consideration of danger to life and great destruction of property, for by obviating excessive strains the life of power house machinery would be considerably prolonged.

THE LODGE-AYRTON MAGNETIC UNITS.

Some weeks ago in commenting upon the paper prepared by Prof. Oliver Lodge for presentation before the British Association on the subject of practical magnetic units, we had occasion to remark upon the regretable insular spirit which it displayed. Though dealing with a matter essentially international in its bearing, no account whatever was taken of the probable wishes of other nations. No reference was made to the proposals on the subject of magnetic units brought before the Chicago International Electrical Congress, or to the extensive discussion they received in the technical press; no attention was vouchsafed to the official reports of the committees appointed to consider the proposals by the French Société Internationale des Electriciens and the German Elektrotechnische Verein. The provisional practical magnetic units of the American Institute of Electrical Engineers were completely ignored, and, notwithstanding the formal adoption and definition of the *henry* by the Chamber of Delegates at Chicago and its legalization by Congress, it was merely stated that, "It has been practically decided in America that this unit [of inductance] shall be named after Prof. Henry, of Washington [*sic*], but the precise definition has not been agreed upon." We believe we are not mistaken when we say that Profs. Lodge and Ayrton were the leaders before the British Association in the movement which led to action with reference to magnetic units. The spirit in which the first named approached the subject is only too evident, and the remarks made by Prof. Ayrton when the report on magnetic units was under discussion before the British Association are no less significant. Referring to the fact that the American Institute of Electrical Engineers had already chosen units and names for the more important magnetic quantities, Prof. Ayrton said that, although he had the greatest admiration for American methods and American "go-aheadedness," he thought they had gone ahead too fast in this matter, "for at the International Congress held in their own country in 1893, it was unanimously decided by the Chamber of Delegates that the C. G. S. system of magnetic units was sufficient for practical requirements. Shortly afterward the American Institute of Electrical Engineers made a communication to the British Institution of Electrical Engineers suggesting names for magnetic units, although the recent congress said such action was unnecessary. In reply, the Institution of Electrical Engineers, acting in accordance with the decision of the Chicago congress that the time was not yet ripe for selecting practical magnetic units and giving them names, deprecated the proposals made by the American Institute, but in spite of this the names had been given." Under these circumstances, Prof. Ayrton said he did not think the British were bound to accept the names and definitions provisionally adopted on this side of the Atlantic, "especially as the units chosen did not form a consistent system with the volt, ampere and ohm." We will merely add that the action of the American Institute of Electrical Engineers with respect to magnetic units took place in 1894, one year, it seems, "before the time was ripe," and that the unanimous decision referred to of the Chicago congress explicitly condemned in advance the Lodge-Ayrton unit of magnetic flux.

A Proposed Electric Passenger and Freight Line.

An electric freight and passenger railway is about to be tried in St. Louis County, Missouri. A company has been organized and the necessary state and county franchises secured. About 90 per cent. of the distance is covered by a right of way over private property. The eastern terminus of the line is at the intersection of Loughborough Avenue and Gravois road. From this point the survey extends in a southwesterly direction about midway between the Iron Mountain and Frisco Railways to Morse's Mill, in Jefferson County, a distance of 35 miles. At this point the company owns in fee simple a water-power which has been pronounced by expert electricians capable of generating sufficient power to operate the entire road. But to prevent any hitch, the company will erect a steam power-house, somewhere on the line, four or five miles from the city. The proposed line extends through a rich farming territory that has heretofore depended solely on the Gravois road as the only outlet for its products and inlet for its merchandise. There are located on the proposed line, nine post-offices, six flour mills, 26 merchandise stores and other business enterprises that transport everything they have to buy and sell by wagon to and from St Louis. It is estimated that over 50,000 tons of produce and merchandise is transported by the residents of this section annually.

The Buffalo-Niagara Franchise.

At the meeting last week of the board of directors of the Cataract Construction Company it was decided to accept the franchise offered it by the city of Buffalso, provided certain amendments are incorporated. The chief of these reduces the money payments asked for by Buffalo from 5 per cent of the gross receipts to 2½ per cent. The directors present at the meeting were Edwin D. Adams, John Jacob Astor, George S. Bowdoin, Charles Lanier, Darius O. Mills, William B. Rankine, Francis L. Stetson and Edward and A. Wickes. John Crosby Brown, of Brown Bros. & Co., and Frank K. Sturges, prominent stockholders of the company, accompanied the directors.

New Storage Battery Traction Company.

The Metropolitan Electrical Development Company has filed articles of incorporation in the county clerk's office in Jersey City. The capital is $1,000,000, and the incorporators are John R. Dos Passos, Conrad N. Jordan, Thomas D. Jordan, Charles N. Canda and William L. Moore, of New York, and Charles N. King, of Jersey City. The company proposes to develop storage batteries for traction purposes, and expects to put an experimental car on the St. Nicholas Avenue road in New York City at an early date.

The Kaiser Followed by a Telephone Car.

The emperor has taken a new departure in the way of communicating with his ministers and others while absent from Berlin. While he is in Rominton he is followed wherever he goes by a telephone car, by the use of which he is enabled to speak from any part of the chase with the foresters, gamekeepers, etc., and also to keep up close communication with the ministers and other state authorities in Berlin and elsewhere.

Storage Battery Traction.

The Fourth Avenue Street Railway, of New York, will soon have several storage battery cars on its line, which will be equipped with chloride batteries. Superintendent Skitt, of the street railway company, states that they will be operated all Winter, and if the severe tests to which they will be subjected are successfully withstood, the system will be fully adopted. Cars of the standard trolley type with 18-foot bodies have been made expressly for the trial; trucks of the standard make also are used, a change in the position of the brake-rods being the only one necessary to be made. The motors are wound for 120 volts, and the controller to be used is similar to that on ordinary trolley cars.

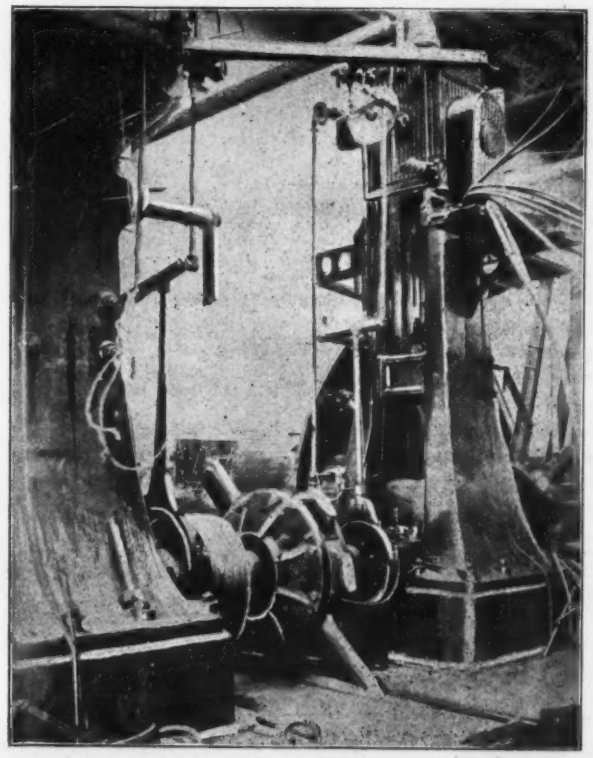
The cells will be placed in wooden trays and hung underneath the car bodies. Each tray will hold 60 cells, capable of operating the car 60 miles on one charge. To change trays the car is run into the car-house and over a pit between the rails. In the pit is an electric elevator carrying a wheeled truck just large enough to hold the battery tray. The elevator is sent up, the tray is detached and the elevator descends to the bottom of the pit. Here the truck carrying the tray of used cells is rolled off at one side, while another truck-load of fresh cells is pushed on from the other side and the elevator is sent up again to the car. The arrangement is such that the connections holding the tray to the car, and also the electric contacts between the cells and the car wires, are automatically made, the whole operation occupying 30 seconds, which is less time than it takes to change horses.

Another advantage of the system is the saving of floor space. All the work takes place in the basement, and no extra room is required between the tracks. The elevator has a rise of six feet. The company intends to have the battery pits in the street eventually, to avoid the trouble of running into the car-house.

By suspending the batteries from the truck, instead of placing them in the body of the car, it is possible to operate open cars by accumulators, which hitherto has been considered impracticable on account of lack of space beneath the seats. Moreover, as the batteries are outside of the car, it is thought that there will be no unpleasant odor from the sulphuric acid, as is sometimes the case. The elements are placed in very deep jars to prevent spilling.

A Serious Fly-Wheel Accident.

An accident, which resulted in the killing of one man, the wounding of two others and the partial destruction of an electric lighting and power plant occurred at Hoboken shortly after 3 o'clock last Saturday morning. One of the 20-foot fly-wheels in the Hudson Electric Light Company's plant burst and the flying pieces of metal, weighing from 500 pounds to nearly two tons, were hurled through the brick walls of the building, some of the pieces being thrown to a distance of over 300 feet. The plant is located at Fourteenth and Bloomfield Streets in a substantial brick building, measuring 100 by 100 feet. The power equipment consists of two vertical cross-compound Philadelphia Corliss engines of 500 hp each, one horizontal cross-compound engine of the same make, and one McIntosh & Seymour double cross-compound engine of 650 hp. The wrecked engine was one of the vertical Corliss, located in the west end of the room. The fly-wheel was 20 feet in diameter, with a 48-inch face, and weighed 50,000 pounds. It was connected to a line of counter-shafting by a 48-inch belt, which passed under two idlers and thence around a pulley on the counter-shaft. Belts extended from the latter to the generators on the floor above, as shown in Fig. 2. At the time the accident occurred nine generators were in operation. Four were 50-light arc machines and five direct-current dynamos supplying power to the cars of the North Hudson County Railway. Just what caused the accident has, at this time, not been definitely ascertained, but the opinion has been expressed that the engine must have been racing from the fact that pieces of the fly-wheel were thrown



THE WRECKED ENGINE.

to such a great distance from the building. Superintendent Bonta's theory is that a short circuit occurred on the line, and when the circuit-breakers were replaced an extra heavy load was put on the engine, causing it to slow down; the engineer in charge then manipulated the governor to allow the engine more steam, when the circuit-breakers again came out, relieving the engine of its load and causing it to attain such a high rate of speed that the fly-wheel burst through centrifugal force.

Whether this theory is correct or not, it is known that the engineer, when the accident occurred, was standing at the governor, which was located on the gallery, between the high-pressure and lower-pressure cylinders directly over the fly-wheel, and was found later on one of the roof girders about 35 feet above the engine-room floor.

Mr. Bonta also stated that, in his opinion, the accident was

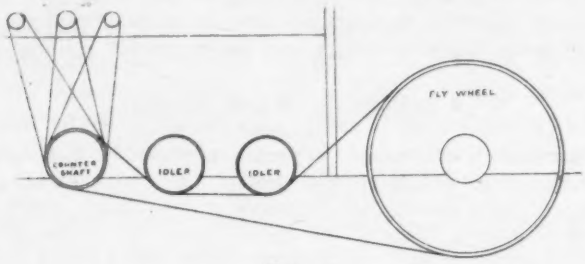


Fig. 2.

not caused by any fault in the construction of the engine or machinery.

Gangs of men were at once put to work repairing the damage and by evening the cars were started running. The damage to the building and machinery amounted to about $9,000.

A German Electric Plow.

If we are to judge by a recent consular report, the electric plow is passing into use in Germany, as their manufacture is written of as if it were an established industry—probably mistakenly.

One of the plows described is shown in operation in Fig. 1. The electric current is generated by a portable dynamo, Fig. 2, which receives its power from an ordinary portable agricultural steam engine and boiler. The plow for small husbandry is of the tilting type shown in Fig. 3. There are two shares, in front of which is a fore cutter to prepare the ground. The frame and all parts of the body are of iron or steel, and so strongly made that furrows of from 10 to 11 inches in depth may be cut even in heavy, clogging ground. The plow may also be fitted with underground looseners, which follow and loosen the sub-soil to as much as 16 inches in depth, but not turning it over.

The electric motor is mounted on the plow frame and its power is transmitted to a chain wheel having a circumferential speed of about 200 feet per minute, at which rate the plow is moved over the field by hauling itself along the length of the chain. The chain

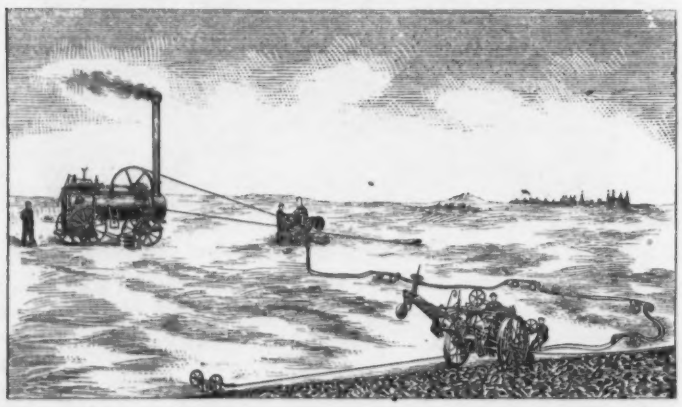


Fig. 1.—Plowing Outfit at Work.

extends across the field, and is held taut at both ends by triple ground anchors (Fig. 5). On reaching the end of the chain, the plow is tipped to the other side and returns in the opposite direction, depositing the chain sideways ready for the next furrow. By turning a lever the ground anchors are drawn and the anchor carriage then moved to the next position. The motor tightens the chain before starting and slackens up behind to allow for any inequalities resulting from the shifting of the anchors, which are also provided with a length of chain for the same purpose.

One end of the pair of cables leading from the dynamo to the plow is affixed to a projecting bar of the latter, and moves forward with it. The friction on the cable on the ground is lessened by means of light cable carriages (Fig. 4), fitted with insulated nippers.

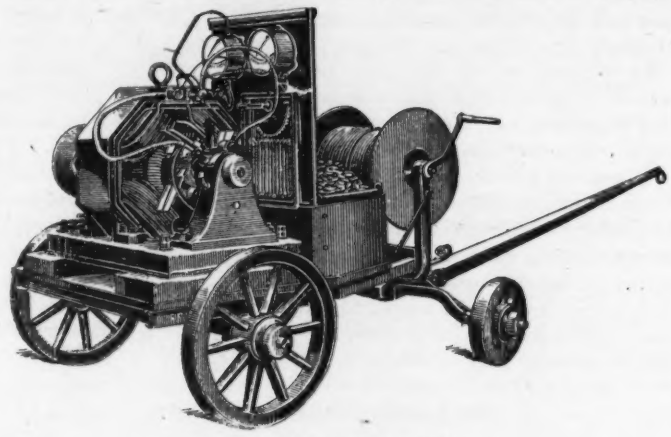


Fig. 2—Dynamo Carriage.

These follow the motion of the plow automatically, as the wheels are fitted into forks which, pivoting in every direction, answer to all the movements of the plow.

On the dynamo carriage (Fig. 2), is a switchboard containing a voltmeter, ammeter and field rheostat; the carriage also serves to transport the haulage chain and a reel for the cable.

Experiments have recently been made with the above plow on heavy, binding, loamy clay soil near Halle, Germany. A 10-hp

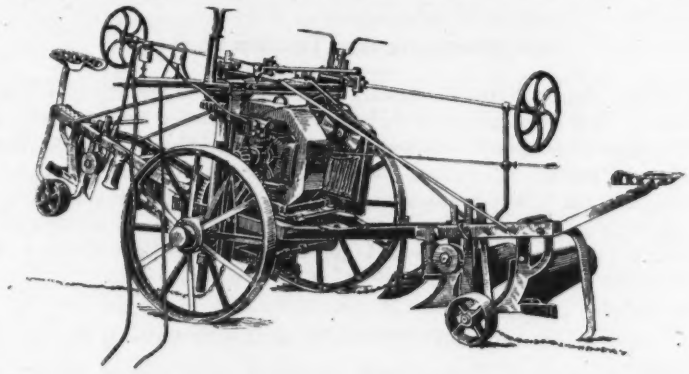


Fig. 3.—Tilting Plow.

portable agricultural steam engine boiler was used, the engine being fitted with a sensitive governor. When the plow was in operation a current of from 60 to 80 amperes and 110 volts was taken, equivalent to about 11 hp. Two furrows, 24 by 10 inches, were turned over by the plow, and a dynamometer registered from 1,350 to 1,570 pounds, or a resistance of from 25 to 27 pounds per square inch of the cross section of the furrow. At the rate of three feet per second the useful horse-power was 7.8, the loss in the transmission of power and tooth and chain friction being therefore about 3.2 hp.

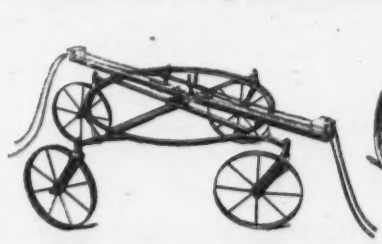


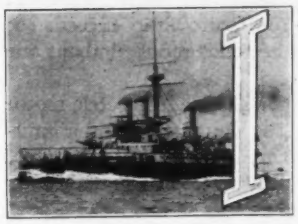
Fig. 4.—Cable Carriage.

Fig. 5.—Anchor.

The manufacturers of the electric plow claim that its entire cost of operation is only about one half as much as by the usual method of plowing. Another form of electric plow is made by the same firm for use on a larger scale, and is intended to receive its current from a permanent generating station.

Electricity in the Italian Navy.

BY GUILIO MARTINEZ.*



IN a publication issued by the United States Navy Department, giving a review of naval progress in 1892 throughout the world, the following paragraph occurs in connection with an account of naval applications of electricity:

"Strange to say, the only foreign naval power that has so far given any attention to this subject is Italy, the great majority of whose vessels do their cruising near home, where they are in reach of supplies. The Italians, however, have adopted a very complete line of standard electrical apparatus for their naval vessels, and are replacing the first installations with the standard type as fast as possible."

This unexpected praise is indeed agreeable. The preceding words indicate in brief the history of the development of electrical application in the Royal Italian Navy since 1887. Before that time, in our navy as in others, there were no precise ideas on the real needs of to-day, or on the necessities of to-morrow. The application of the electric current was confined to projectors, which apparatus was the principal subject of thought and experiment. It was not yet believed that incandescent lighting would become the normal system of illumination on shipboard. It was not imagined that in a few years on the great ironclads, there would be one or several dynamos in operation night and day without interruption, not only in order to give light, but to supply power for running ventilators, ammunition hoists, capstans, pumps, gun turrets, etc. In Italy, therefore, as elsewhere, little attention was paid to the types of generators, except that they should occupy but little space. After having tried Siemens dynamos, the Italian navy adopted in a great part French types of apparatus constructed by Sautter & Lemonnier. Gramme dynamos, coupled to Brotherhood engines, were installed, and of all dimensions, in general, one machine to a single light.

But the number of projectors on a single ship multiplied, and the time came when 13 were in use on a single ironclad, as well as, for incandescent lighting, a large number of Brotherhood-Gramme sets of low electrical efficiency and wasteful in the consumption of steam. Attention then began to be directed toward the uneconomical features of these installations and to their insufficiency, which had become apparent even in the first attempts at shipboard lighting. It was finally decided to abandon this primitive apparatus and to seek a type of engine and dynamo of lighter efficiencies and better adapted for continuous running. At about the same time it was decided to employ incandescent electric lighting on all men-of-war and to make all installations conform to certain general principles.

After several trials choice was fixed on the Victoria dynamos of the Brush Company, and there has thus far been no occasion to regret this action. There are now only five cruisers, and all of the same type, which have other than Victoria dynamos, these being provided with 150-ampere "Duplex" dynamos and vertical engines, supplied by Messrs. Sautter-Harle. Even the vessels which were constructed in foreign countries and until very recently employing Parsons' turbine sets, have now standard apparatus. The torpedo boats are an exception, but their installations have not always a permanent character; at present a design is under consideration comprising a special combination suited to the very difficult conditions which are encountered on small boats.

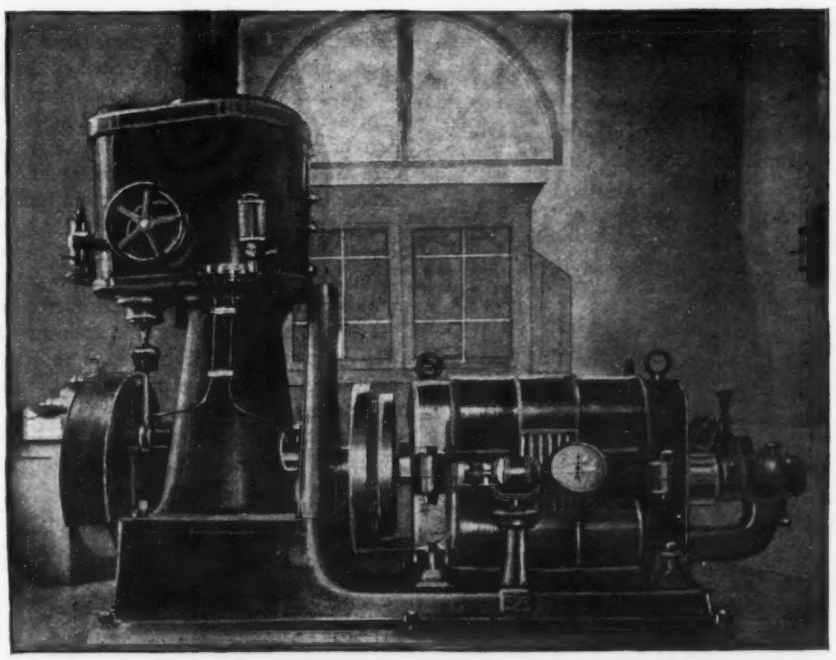


FIG. 1.—19.5-KW VICTORIA-TOSI GENERATING SET.

The condition that dynamos with compound winding should maintain a constant voltage with different speeds, provided the speed be kept constant, is admirably fulfilled by the Victoria type. It often happens, however, that the engine cannot be supplied with a constant steam pressure, in which case the number of revolutions vary and, therefore, the E. M. F. This inconvenience cannot (since governors have been adopted whose regulation cannot be varied during operation) be obviated except by putting a rheostat in the shunt, which, however, is not a great complication.

Having decided that all vessels of a certain importance should have at least two electrical generators, four types of dynamos were selected—of 300, 200, 150 and 100 amperes, respectively. That of 150 amperes has, however, received but little employment in the latest vessels, and recently a type of 60 amperes has been added.

The dynamo once chosen, the next thing was to fix upon an engine. Brush engines were first employed, and in the meantime experiments on a large scale were being carried on with an engine made in Italy. After long trials a particular type was found to be superior to all others manufactured in Italy, and even, in many respects, to any made in foreign countries. This is the marine type made by the firm Tosi, of Seguano, with a single cylinder, or with the two cylinders in tandem when compounded.

The Tosi type of engine, which the manufacturers have constructed by hundreds, is found on all new vessels and gives the best results, not only with the small types (7 to 8 hp), but with the large ones (36 hp). All the engines are of the same design and also of the same type as those of 150, 200 and 500 hp, which the Tosi Company constructs for industrial purposes. Of the five classes which the navy has adopted, those for dynamos of 100 and of 60 amperes are simple engines and those for 300, 200 and 150 ampere machines are compound. The engine is direct-connected to the dynamo by means of a Raffard coupling, with bands of copper instead of rubber rings. The 300-ampere set runs normally at 260 revolutions, the 100-ampere set at 350 revolutions, and the 60-ampere set at 450 revolutions per minute. The wheel governor is similar to that of the Westinghouse and Armington & Sims' engines; it is both simple and strong, the weight of its parts add to the fly-wheel effect, and its sensitiveness is very great. If the speed tends to vary, the governor acts on the steam valve and changes the ratio of expansion. Each governor can be regulated for a speed differing greatly from the normal, but this modification can only be made when the machine is at rest. On the other hand, one can trust implicitly to the governor maintaining a certain speed, the variations not surpassing 2 or 3 per cent. even in changing suddenly from no load to full load, or for a change of 10 or 15 per cent. in the steam pressure, either above or below normal. The consumption of steam is very economical. In running at full load the 300-ampere sets at a steam pressure of from 70 to 120 pounds, 49 pounds of steam are used to the useful electrical horse-power (736 watt-hours). This consumption is reduced to 40 pounds, when a condenser can be used. It is well to bear in mind that the commercial efficiency of dynamos running at low speed does not much exceed 86 per cent. The commercial efficiency of the set, that is to say, the ratio of the useful electrical horse-power to the indicated horse-power, is, therefore, about 78 per cent., from which it follows that the consumption of steam per indicated horse-power does not exceed 31 pounds with a condenser. The consumption of steam with engines of other similar types may be as high as two or three times this.

The great solidity of these engines is not their least advantage, as

* Written for THE ELECTRICAL WORLD with the authorization of the Italian Naval Department.

they are almost always subjected to very long service, and it is an undoubted and considerable advantage to have only two supports for the shaft. Figs. 1 and 2 give an idea of the type of these engines and of the corresponding generating sets. The installations which do not have Tosi engines have the Brush or the vertical Sautter-Harle type (used with "Duplex" dynamos), or Odero engines of Italian make. Naturally, these various types will be retained as long as they are in good condition, but in a few years there will probably be only a single make of engine employed.

With the exception of the dynamos, projectors and measuring instruments, all apparatus and material is of Italian origin. The national industry is certainly in condition to furnish dynamos and perfect measuring instruments, but it has been desired up to the present to preserve uniformity in generators and switchboards on all vessels. Dynamos of Italian manufacture are used for all shore installations, such as coast defense works or for the illumination of arsenals, or where a general uniformity of type does not constitute an appreciable advantage. It can, however, be predicted that in the very near future no foreign apparatus or material will be used. When, in 1887 and 1888, the general considerations governing installations on all men-of-war were fixed, it was also decided that all material ought, if possible, be procured in Italy, and the development of the national industry has permitted the purchase of foreign material to be continually reduced, with the consequence that the navy is now not necessarily dependent upon foreign manufacturers.

The insulated wire of all kinds used is made by two establishments well known even to the rest of Europe—the firm of Pirelli, of Milan, and Tedeschi, of Turin. The first makes all kinds of gutta percha and caoutchouc manufactures, and at Spezia has an auxiliary establishment for the construction of special marine cables. The second makes great quantities of dynamo wire, for which Switzerland has offered a large market.

In the navy the conductors consist of cables insulated with coverings of caoutchouc and textile material. In the fire rooms, where the conductors are subject to moisture or oil, there is an exterior covering of lead. There is a particular scale of sizes, varying from .7 to 170 square mm in section. The conductors are of tinned copper and consist of a number of strands, greater or less according to the size. In the cabins and staterooms double silk-covered conductors are in considerable use.

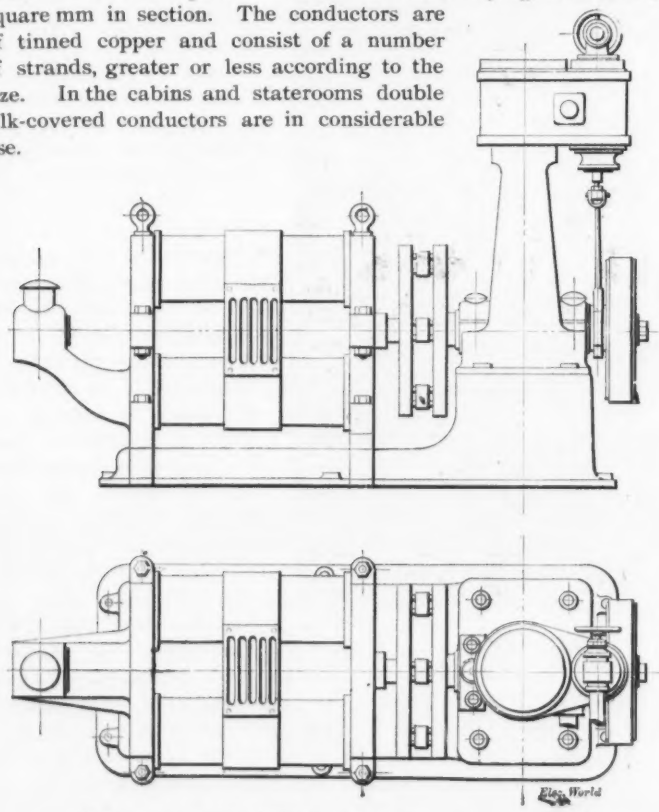


Fig. 2.—6.5-kw Victoria-Tosi Generating Set.

For incandescent lighting, the Cruto lamp is exclusively used. Tests were made of almost all the lamps found in Europe, and the Cruto was found to be superior to all others. It should, however, be noted that the Cruto firm manufactures for the navy a special type, made with extreme care. It is of the greatest importance, in the naval service, to reduce the breakage of lamps and the supply which each ship should carry. To that end it has been decided to employ only lamps of extra quality, and of but two types—of 12 cp with Edison bases, for ordinary service aboard ship, and of 25 cp with a special base, serving exclusively, singly or in groups, for the running lights and signals. All the lamps are tested at the electrical laboratory, at Spezia, under the same conditions, and all vessels can be supplied from the storehouses and arsenals with lamps identical with those in use. The average life of the Cruto lamp exceeds 800 hours, after which time the candle-power becomes reduced about one third.

Up to the present there is only one special type of electric motor adopted. The motor usually employed for ventilators and ammunition hoists is that of the C. & C. Company of the United States, which is manufactured in Italy by the Edison Company of Milan. There are also a large number of Siemens motors in use besides several other types, and tests are being made of waterproof motors.

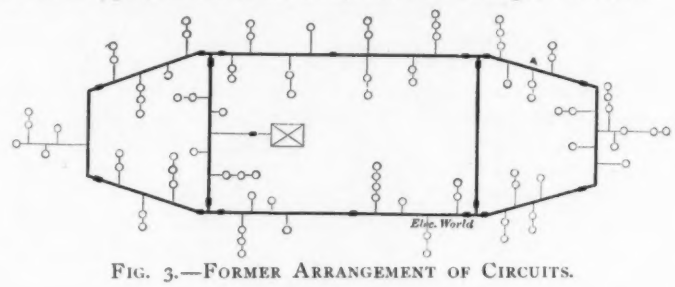


Fig. 3.—Former Arrangement of Circuits.

All accessories of installations, such as lamp sockets, supports, lanterns, cut-outs, etc., are of Italian manufacture. Various types of these devices have been modified before answering to the needs of men-of-war. These and the material are of the latest models and are much more solid and perfect than formerly. The type of lanterns adopted does not differ much from those that are in use elsewhere.

The other accessories have no special importance. Some of them present a particular interest, but not sufficient to be considered in this summary account.

The system followed has, it will have been noted, permitted the realization of the programme laid down since 1887—a programme whose aim can be briefly stated to be the creation of types of installation suitable to men-of-war and their application in all ships. The last installations are but improvements on former ones. The plan has not been changed because the idea always present has been that uniformity of material and appliances adopted was the surest means to properly maintain installations placed in charge of a non-permanent personnel, and one which often cannot have the benefit of but limited practical instruction.

The entire personnel of Italian war vessels is military and obtained by conscription, the men remaining only a few years in active service. Those who are fishermen or carpenters by occupation are able after a few months to run dynamos. In order to obtain the maximum of useful effect the things which these men have to learn are reduced to few in number, but well taught. Those who are assigned as electricians or torpedo men are taught their duties on a special vessel (*Scuola Torpedienne*) and when they are distributed, after completing the course among the other vessels, they deal with matters in which they have thus received instruction.

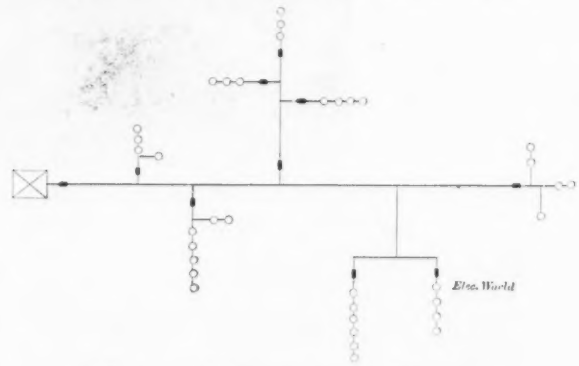


Fig. 4.—Arrangement of Circuits.

There has thus been adopted a single type of dynamo; a standard voltage (65 volts), suitable equally for projectors and for distribution of energy, even extensive in amount through limited distances; a single type of incandescent lamp; a single type of automatic lamp projector; a single type of switchboard; a single system of distribution, and very few types of fuses, switches, etc.

The coupling of dynamos in parallel has been abandoned, as well

as using the vessel for the return circuit, and all conductors are in wooden moulding. The conductors, whether simply insulated or covered with lead, are placed in teak mouldings, which contributes greatly to the life of the installation. There are separate circuits for the projectors, signals, motors and lighting; the lighting circuits are several in number, according to the circumstances. In the subdivision of circuits the original ideas have been modified and a reduction in their number made. On the large ironclads the number of circuits was formerly excessive, thus not answering to the real needs of vessels abounding in dark places. On new ships there are no longer separate port-circuits, sea and fighting circuits, engine-room and bridge circuits, which formerly led to conflicts in changing lamps from one circuit to another.

In modern installations there are *protected* circuits for all the protected parts of the vessel, and *non-protected* circuits above the water

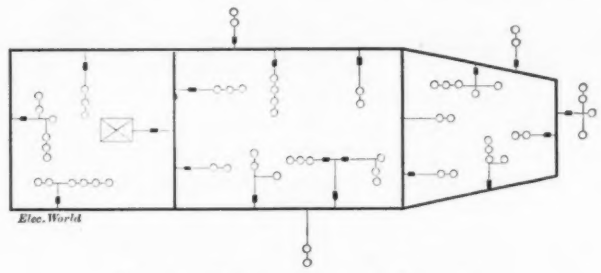


FIG. 5.—ARRANGEMENT OF CIRCUITS.

line. While in the first installations the great subdivision of circuits and complicated distribution of lamps obviated the use of switches (the lamps being lighted from the switchboard), now there are switches on all the principal branches and on groups and single isolated lamps. The number of cut-outs is relatively increased, though each of them represents on a vessel a weak point in the installation. At present there are on a single fuse a smaller number of lamps than formerly, seven or eight at a maximum, and three or four on an average.

After one or two trials the system of distribution was entirely abandoned in which the principal conductor did not form a simple circuit with no cut-outs along its entire length. The type of distribution indicated by Fig. 3 has been abandoned, and the only kind used now is that shown in Figs. 4 and 5. Experience has proved that short circuits are produced only at the extremities of branches near lamps; cut-outs are, therefore, only placed at the origin of circuits, on the switchboard; sometimes, though not always, on larger branches, and always on the leads to groups of lamps. On the largest and most recent vessels the principal cable forms a true network, fed by one or two feeders, but as the two conductors always lead in the same direction and have no cut-outs along their length, the distribution forms a very simple system.

(*To be continued.*)

General Track Construction.*

BY C. LOOMIS ALLEN.

A great many obstacles are encountered in finding foundations for electric roads, with which the steam roads do not have to cope. Some few railway companies have become so thoroughly discouraged in attempts to obtain firm foundations that they have been to the great expense of placing concrete foundations six inches thick under the ties to support them, thus bridging the various settlements. This method may be practical in some cases where firm foundations are not obtainable, but beyond these extreme cases, its cost removes it beyond practical use. I maintain that trenches can be properly filled, and by the aid of sufficient rolling, a firm sub-grade can be obtained, permitting the use of broken stone ballast, and lessening the cost of concrete foundations by two thirds. Remove all soft and spongy places in the sub-grade; lay tile drains connected to sewers at such points as seem at all springy, and have the line of the sub-grade, after it has been thoroughly rolled, conform in line and section to the finished grade. Upon the sub-grade should be spread the ballast, and no better quality of ballast can be obtained than stones that have been broken in a crusher to a size that will pass through a two-inch ring. There should be not less than eight inches of broken stone ballast under the ties after the track has been surfaced and tamped. The broken stones should be evenly spread in the trench to such a depth that having been thoroughly rolled, will be not less than six inches. The rolling should be done by a steam roller weighing not less than 10 tons, and should be continued until the mass of stone shall become thoroughly compact. Upon the broken stone then place the ties. The use of metal ties is bound to come. The New York Central Railway, as a practical experiment, constructed a short piece of track on the Hudson River division, near Garrison station, in 1889, using the type of metal tie known as the "Hartford." The results so far have been very satisfactory and the cost of maintenance reduced to a minimum. In drawing specifications for wooden ties, do not place clauses in them which experience has taught you it is impossible to fulfill. Specify the kind or quality you know can be bought in the market and make the size not smaller than the standard size, *i. e.*, 8 feet long, 6 inches deep and 8 inches wide, and by all means see that the ties you buy are the same as the specifications called for. Do not place less than 120 lineal inches of ties in width to a rail length of 30 feet.

The rails to be used in streets of cities should weigh not less than 85 pounds to the yard, to a section 7 inches deep, and if the section you purchase is 9 inches in depth, it should weigh not less than 95 pounds to the yard. Select a section with a good wide base, not less than 5¾ inches, and have the width of the head not less than 2½ inches. Almost any standard section of the 9-inch rail offered by rolling mills is good. There are differences of opinion as to the quality of the finish of the different sections of rail. Some maintain that the girder rail with the tram or "L" head is better finished and more easily kept open to traffic than the half grooved girder sections.

The fish-plates or channel bars should be at least 32 inches in length, and if for the 9-inch rail, should be punched for 12 1-inch bolts. I believe the corrugated plate type is the best yet presented, but with any channel bar or plate of the length of 32 inches, bolted tight with 1-inch bolts, and the nuts held in place by nut locks, the joints should not give way sooner than the rail itself. In fact, the question of joints with fish-plates of this size, properly bolted, is transferred to a question of ties and what supports them.

Use combination brace plates; do not use tie rods. With the former you have a track laid with greater care, so far as gauging and spiking are concerned, than you will have with tie rods, and that is very essential to first-class and easy-riding track. Tie rods in a pavement tend to constantly help, by vibration, the disintegration of the pavement, to say nothing of the trouble encountered in paving around them.

In laying tracks in city streets, place the rails on the ties, making the joints alternate, and, no matter what the temperature may be, be sure the joints are laid without open spaces between the rail lengths; butt the ends of the rails up tight, and, when they are in position, bolt the plates up, driving them home with a hammer. Do not spare the cost of inspection at this point, but be sure that the joint plates are all tight. With properly bolted plates and rail ends tight, you have approached as near a continuous track as is possible without welding the joints, and yet you have given a chance in extreme Winter weather for contraction.

In driving the spikes be sure that the gauge-bars are tried on every tie. Use 5½ x 9 1-16 spikes, four on every tie. When the rails are thoroughly spiked and bolted, the track is ready for surfacing and tamping. Great care should be taken to properly tamp each tie firmly. Ties tamped with broken stone ballast do not sound as firm as ties tamped with gravel ballast, but broken stone will stay in place, while gravel ballast will wash down. Tamping with broken stones costs more, but firmer track is the result. The track now is ready to receive its final alignment, and with great pains and care see that all irregularities in line are taken out. Unless block stone pavement is to be laid, fill to the top of the ties with broken stone, made thoroughly compact by the use of rammers, and you can rest assured that, with a space of nine inches from the top of the ties to the surface of the pavement, in which space can be laid the pavement and its foundation, that there will be no objections from the municipal authorities of poor foundations. Once more try the bolts and fish-plates to see that all are tight, and then place on the bolts the nut locks to keep them tight. Your track is now ready for bonding. Use the type of bonds that will give the greatest contact with the rail connected by a single No. 0000 wire. The use of single bonds of a larger size saves labor when compared with the use of double bonding with bonds of a smaller size.

* Abstract of a paper read at the New York State Railway Convention, Albany, Sept. 17, 1895.

The Delineation of Alternating-Current Curves.

At the Ipswich meeting of the British Association, Messrs. James Mark Barr, W. B. Burnie and C. Rodgers presented a paper describing a method of automatically recording, with great rapidity, the shape of alternating-current curves by means of an optical arrangement.

The principle of the method consists in the combination of two motions at right angles, relatively to a screen, of a spot of light—one motion corresponding to time and the other to potential differences obtained by means of a contact brush moving slowly and continuously through successive angular positions.

The arrangement of the contact disc and accessories is shown in Fig. 1, a galvanometer being used, though an electrometer might be substituted. In this diagram, for the sake of clearness the vulcanite foundation work is omitted and the brass only shown. The motor having four poles, two knife-edge contacts, placed diametrically opposite, are used, which give one contact per wave. D_1 is a contact disc rigidly fixed to the shaft of the dynamo or motor, and to it are attached the knife edges just mentioned. The rings, D_2 and D_3, and the rods and brushes, B_1 and B_4, are mounted on one piece of vulcanite loose upon the shaft and are slowly revolved. The brush, B_1, is joined to the ring, D_2, with which the brush, B_2, is in permanent connection; when the brush, B_1, makes contact with the knife edges, the condenser, C, is charged to the potential difference existing between the terminals, T_1, T_2. The condenser is, throughout the whole revolution of the disc, D_1, discharging through the galvanometer, G, by way of B_3, B_4, B_5, and the resistance R.

As the brushes B and B_4 are moved slowly around, a succession of charges passes through the galvanometer; the value of each

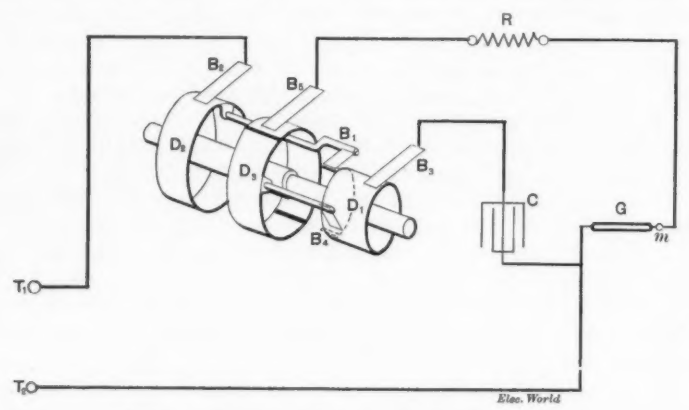


Fig. 1.—Contact Disc and Connections.

charge is proportional to the instantaneous E. M. F., and a corresponding movement of the galvanometer is obtained.

The relative movement of the spot of light at right angles to the motion due to the galvanometer is produced by the oscillating mirror. This mirror, M, is shown in Fig. 2, which is a plan of the general arrangement. Mechanically connected with the disc, D_2, D_3 (Fig. 1), and moving with the same angular velocity, is a cam marked K, which is shown in Fig. 2. The mirror, M, is pivoted about a horizontal axis and is oscillated by the arm, a, which bears on the cam. The arm is kept pressed against the working edge of the cam by the spring, S. If the edge of the cam is properly shaped a horizontal motion of the spot of light in synchronism with the angular motion of the brush is obtained.

By combining the two motions of light during the oscillation of the mirror, M, in one direction, the spot is caused to trace out a wave form on the screen, P. To prevent the tracing of a reversed wave, which would interfere with the true image, the ring, D_3 (Fig. 1), is discontinuous, so that the brush, B_5, does not make contact during the return oscillation, and the spot draws a zero line.

By placing a piece of sensitized paper or a sensitive plate on the screen, a permanent record of the path of the spot is obtained. The angular velocity of the moving brushes may be made so small that a well-damped instrument even of long period may be used. For use with an ordinary electrometer the plane mirror may be made to oscillate about a horizontal axis and a curve drawn whose zero line is vertical.

The cam may be dispensed with and the screen itself moved, either horizontally or vertically, with gearing; or a cylinder covered with sensitive paper may be attached to the moving brushes and the deflection of this made to move the spot axially on the cylinder. But there are certain disadvantages attached to this method of experimenting which led to the construction of the apparatus with the cam. There have been brought out lately several methods for building up current and E. M. F. wave shapes. In using this apparatus during the process of building up wave forms, the required

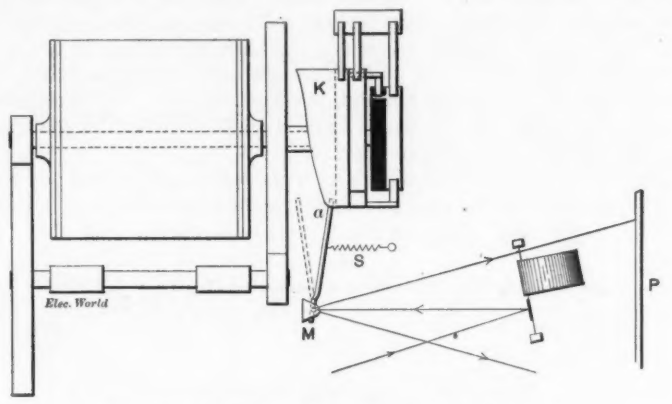


Fig. 2.—Showing Arrangement of Mirror.

shape may be drawn upon the screen and the course of the spot of light observed, it being noted wherein it differs from that curve and steps taken to insure a close coincidence. With the form of apparatus in which the cam is not used this process is more difficult.

A short time ago Dr. Fleming published a new and ingenious method of plotting wave forms with polar co-ordinates, and of directly obtaining therefrom the mean square value. The present apparatus may be easily modified so as to obtain a record of one of these polar waves. For this purpose the slow moving disc must be mounted on the extreme end of the shaft and a sensitized screen fitted thereon, the instrument being so placed that the zero position of the spot of light is on the centre of the disc, and the deflection along one of the radii. The curve traced will then be of the required form.

By a system of mirrors it would be possible to obtain the same result with the screen fixed, but this appears to offer no special advantages.

The galvanometer used with the apparatus is of the Ayrton-Mather type with a horizontal coil but no silver tube for damping. The coil is wound with 260 turns of wire 1.4 mils in diameter with a resistance of 400 ohms. The period is small, being about .02 second. The damping is effected by a light glass arm dipping into an oil vessel the height of which can be adjusted.

An electrometer would have been preferable, but it is difficult to obtain an electrometer of sufficiently small period. For tracing the

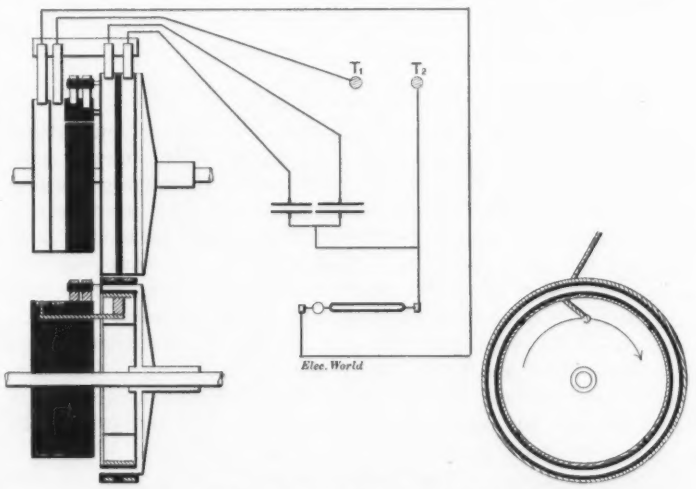


Fig. 3.—Arrangement for Low Frequencies.

wave very slowly an electrometer may be used, but one of the advantages of the present method over the methods in ordinary use is the rapidity with which the wave may be traced. In many experiments there is a variation of speed with time, against the effects of which it is necessary to guard, but in tracing a wave in a few seconds no appreciable variation of speed can take place.

If the spot of light were made to trace out the wave form sufficiently rapidly the curve would appear as a continuous luminous line. This can be effected with the apparatus as it now stands with *high* frequencies. With low frequencies, however, that is impossible. For instance, with a frequency of 80 per second 80 contacts per wave are obtained. But since for the line to appear continuous, the slow-moving disc must make at least five revolutions per second, the number of contacts cannot exceed eight per complete period or four per half period—an obviously insufficient number.

A diagram illustrating a method by which this difficulty is overcome is given in Fig. 3. As before, the apparatus consists of two discs, one moving at the speed of the motor and the other a slow-moving one. The slow-moving disc carries two collecting rings, two brushes and an internal four-part commutator. Each collecting ring is connected to a pair of opposite commutator segments, and the slow disc carries two brushes, which bear on the fast disc and are connected one to each collecting ring. The fast disc also carries two collecting rings, one connected to the knife edge and the other to the fast revolving brush bearing on the four-part commutator of the slow-moving disc. One of the two brushes carried by the slow-moving disc is slightly in advance of the other, and the disc is rotated so as to have a definite speed relation to the fast disc. The two condensers are charged in rapid succession as the knife edges pass the brushes, and during the remainder of the half revolution are discharged in succession through the four-part commutator, the fast revolving brush and the galvanometer. The effect is to get *twice* as many discharges through the galvanometer per wave as are obtained with the apparatus shown in Fig. 1. Three or more condensers can be used, the total number of contacts per wave obtained being proportional to the number of condensers used. For all ordinary purposes, however, the apparatus with one condenser will be found sufficient.

Economical Equipment and Operation of Power-Houses.

In a paper with the above title read at the Albany Convention of the New York State Street Railway Association, Mr. H. S. Newton gives an account of various economies introduced or about to be introduced in the power-house of the Syracuse Street Railway Company. At present the feed-water is introduced into the boilers through a line of 2½-inch piping connected to duplicate pumps through a pipe heater. Two objections have been found to hold against the arrangement as adopted, the correcting of which will influence somewhat the economy of the station. The first of these is the fact that in covering the live steam pipes it was not deemed necessary to cover those carrying the warm water to the boilers. This leads to a difference of some five or ten degrees in the temperature of the water when leaving the heater and when entering the boiler, and is, consequently, a source of some little loss. The second point is the absence (since remedied) from the feed-water line of a check valve beyond the pumps to relieve the check valves at the boilers. This would seem to be of small importance if not absolutely unnecessary, but it was found of decided advantage in prolonging the life of the valves and doing away with the rattle occasioned in these valves by the pulsations of the pumps. An air chamber over the pumps is also of prime importance in lending elasticity to the system.

Attention is called to the importance of an injector on each of the boilers. There seems to be a growing tendency to rely entirely on a relay of pumps, thus allowing the operation of the station to hinge on the efficiency of a piece of apparatus which, Mr. Newton says, his experience goes to show has a decided tendency to get out of order.

The character of the water around Syracuse made it very desirable that the condensed steam should be utilized, if possible, and after what promised to be some very disastrous experience, a condensing apparatus is running very successfully and over 90 per cent. of feed is obtained from this source.

The immediate result on starting this practice was oil in the boilers, or a mixture of oil and dark brown sediment, which caked over the bottom seams. This was removed and another trial made, it being thought the deposit might be shop grease and dirt, but with the same result. Examination of the oil filter showed nothing out of order, and consultation with the engine builders evolved nothing new. After endless experimenting, resulting in a leaky boiler or two, and the consumption of a vast amount of chemicals, the trouble was satisfactorily located and remedied.

The accumulation noticed seems to have been the result of three causes: (1) the use of too much cylinder oil; (2) the use of the wrong kind of cylinder oil; (3) insufficient filtration of the oil from the feed-water before going to the boiler. The first of these causes was, of course, soon remedied, and the old-fashioned notions of engineers were shocked with the order to use only three drops a minute for each engine. The remedy for the second cause was longer in being discovered. Various expedients were tried for cutting up the grease in the boilers, such as carbonate of soda, soda ash, tri-sodium phosphate, and, lastly, kerosene oil. None of these expedients proved effective, however, and it was not until the cylinder oil was changed that the problem was solved. Some oil of purely mineral stock was purchased, and has worked so well as to lead to the conclusion that it must have been the animal fat in the other oil which was doing the mischief. This oil is now being used with remarkably good results, never more than a slight film being apparent in the boilers at the time of the weekly cleaning, and this readily succumbing to the action of a half pail full of soda ash pumped in with the feed-water before cooling off. The third cause of trouble was recently largely overcome by introducing a number of partitions in the oil filter, by means of which the water is caused to flow alternately over the top of one end under the next, in this way allowing the oil to settle from its water emulsion, and be collected in the excelsior filling.

At Syracuse the best coal was found to be anthracite buckwheat, costing on board cars delivered at the station, $2.25 per gross ton. Dust anthracite was found to sift through the bars; when mixed with an equal quantity of soft coal it worked well, but necessitated the help of an extra man as mixer, and it is not so economically fired. Thirteen tons of buckwheat per day are used where it was necessary to use 17 or 18 tons of the mixture.

As to the efficiency of special devices, such as low water alarms, automatic damper regulators, etc., in the boiler-house, the results obtained at Syracuse are declared to be good. It was found that the less responsibility placed on a man who shovels in the coal, the better off one is in the end; or, in other words, that as compared with human brains, the mechanical device is at a big premium. By making the engineer responsible for the operation of the devices and keeping them in repair, a great deal better boiler-house economy is insured than could otherwise be obtained.

The vertical marine type of engine has given thus far very good service. The most serious objection that can be urged to them is that they are noisy. In order that the vertical cross-head guides may not be subjected to too serious wear, it was found necessary to lower the compression below the point usually employed. The natural consequence is more wear in the cross-head crank bearings and more noise, but it is considered the lesser of two evils has been chosen. The engines are provided with piston valves for the high-pressure, and grid-iron slides for the low-pressure, cylinders, the regulation being within 3 per cent. The desirability of good engine government is emphasized, both on the score of economy and satisfactory running of cars.

Stress is laid against the use of cheap labor in the power-house. A condensing station, with the volume of detail which must be always present in its construction, requires brains for its operation; and the man with brains commands good wages. The pressure that is brought to bear on the management for reduction of wages in the power-house is often severe, but the moment the concession is made trouble begins. At Syracuse the chief engineer is paid $100 per month.

In the discussion of Mr. Newton's paper, Lieut. J. B. Cahoon, of the Elmira Improvement Company, said he thought that possibly the steam pressure has a good deal to do with the class of coal to be used. At Elmira a long series of experiments was made on the use of various forms of anthracite and bituminous coal. With 160 pounds pressure, and compound-condensing engines for the railway, and triple expansion for lighting, it was found that the Eureka Clearfield coal gave the best results. Power for both the railway and lighting stations is generated by the same plant, which gives an advantage. Most of the experiments were made with bituminous coal, because operating at that high pressure and having vertical tubular boilers, it was found anthracite coal fired badly and did not give good results. Various kinds of bituminous coal were tried, many of them from the Clearfield district. The cheapest grade was $1.60, but did not give anywhere near as good results as the Eureka at a higher price. It is landed in the bin at $1.95, and it costs about five cents more to get it to the fire-room, having to be carried in a cart some little distance.

Magnetic Units.

The London *Electrician* of Sept. 27 gives an abstract of the discussion at the Ipswich meeting of the British Association on the recommendations made by the Committee on Electrical Standards concerning magnetic units. The rational system prepared by Prof. Heaviside was constantly referred to, and spoken of as likely some day to lead to the remodelling of the entire system of electrical units.

Prof. S. P. Thompson expressed himself as believing that, if magnetic units were chosen of unpractical size, such units would die at once and never be of service to the industry. In his opinion the *magnitudes* of the units were of far greater importance than the *names*, for the names were only details. No doubt they were important details, and unless judiciously chosen might give rise to international jealousy.

For industrial purposes a unit for "total lines," he said, was greatly needed, since a good idea of the dimensions of a plant was given to practical men if the number of lines be known. At the Chicago Exhibition the largest machine shown had a total flux of 15 million (15×10^6) C.G.S. lines, whilst the smallest had about forty thousand (40,000), the former being a large generator and the latter a small fan motor. Since that time larger machines have been built, having, say, 60 to 80 million lines. The usual density at which wrought-iron was worked being 15,000 to 17,000 C.G.S. lines per square centimetre, or between 90,000 and 100,000 per square inch, the total flux gave a fair idea of the section of the magnets. At present the *line* was the unit of magnetic flux, and originally this small unit was of convenient size, because only small quantities of magnetism were then dealt with. The chief objection against its use now was that we had no prefix to carry us beyond the sixth power of 10 (megaline = 10^6, or 1 million lines). The electrical standards committee now suggested 10^8 C.G.S. lines as the unit, and this he (Dr. Thompson) thought ought not to be accepted without good reason. The reason *for* proposing this unit had been stated by Dr. Oliver Lodge to be because it fitted in with the system of practical units at present in use, for a volt is generated when lines are cut at the rate of 10^8 per second. *Against* the adoption several reasons might be given. In the first place, the unit was too big, and would result in all fluxes being expressed as fractions, usually very small fractions. In his opinion it would be much better to have a small unit, and express larger fluxes by prefixes, such as *kilolines* for 1,000 C.G.S. lines, and *megalines* for 1,000,000 such lines. Another reason was that the American Institute of Electrical Engineers had already suggested a system of magnetic units not the same as that now proposed by the committee, and had, moreover, used the name "weber" to mean one C.G.S. line. He did not see why the "line" need be rechristened, but this might be left open to further discussion, and we certainly had already the right to use the terms kiloline and megaline.

Speaking of the second unit to be defined, Prof. Thompson said the "ampere-turn" had been already adopted universally by practical men as the unit of magnetic potential, although Dr. Hopkinson and others multiplied by $4\pi/10$ to get C.G.S. units. In most cases curves were employed to pass from cause to effect (magnetic potential to magnetic lines), so why not adopt such a scale in plotting the curves so as to pass direct from ampere-turns to magnetic lines? Even if the "gauss" proposed (one C.G.S. unit) be adopted as the unit, he believed practical men would still scale their curves in ampere-turns. For some purposes, no doubt, the ampere-turn would be ridiculous, as, for example, in work relating to permanent magnets, and here the "gauss" would be appropriate. A reason *for* adopting the unit and name proposed by the committee was that they met a want. *Against* the proposition was the fact that a name had never been given to a C.G.S. unit before, but only to multiples or submultiples of such units. At the B. A. committee, in 1881, one of the reasons why one tenth of a C.G.S. unit of current was taken as the practical unit (the ampere) in preference to the C.G. S. unit, was to avoid giving a special name to a C.G.S. unit; the fact that glow lamps required currents of about one tenth a C.G.S. unit was another reason. In America the name "gilbert" had been proposed for the unit now under discussion, and it was a pity to come into conflict with our friends across the Atlantic on this point. At the same time a word of one syllable, such as gauss, was preferable for magnetomotive force, and a word of two syllables for the resulting flux, because the quantities were somewhat analogous to electromotive force and current, for which words of one and two syllables respectively (volt and ampere) were in common use. Consequently, he thought our "gauss" should be retained and the American definition of "weber" agreed to.

In his opinion it would be a great pity to attempt too much christening at once, and he recommended that only the two units for flux and magnetomotive force be settled, and the rest be allowed to settle themselves. Unless this was done some of the units would soon become antiquated.

The remainder of Prof. Thompson's remarks refer to the "rational" units proposed by Mr. Oliver Heaviside, of which he holds a high opinion, and believes that at an early date the entire system of C. G. S. units may be remodelled to conform to the plan suggested by Mr. Heaviside. Later in the discussion Prof. Thompson pointed out that the American Institute of Electrical Engineers said they did not want to create new units, but required names for the old ones. The names, however, had only been provisionally adopted in America. Although the ampere-turn would be used by practical men, he hoped the gauss, as proposed by the committee, would be the unit of magnetic potential. As to the choice of the magnitude of the ampere, he said that at the York meeting of the British Association the fact of glow lamps requiring currents about one tenth of a C.G.S. unit was brought prominently forward as an argument why one tenth should be chosen as the practical unit, and this found favor on the Continent as being nearly equal to the current sent by a Daniell's cell through one Siemens unit. Dr. Johnstone Stoney had objected to naming units not belonging to the ohm system, and suggested affixes for multiples or submultiples of those units. He (Dr. Thompson) thought this might lead to difficulty, for terminations were not the same in all nations. He instanced the circumstances that the Italian electricians would not use the word *volt*, but called it the *volta*.

Prof. Ayrton said that Dr. Thompson in his remarks had given reasons why the recommendations of the electrical standards committee should not be adopted. He himself wished to look at the question from the opposite standpoint. Referring to the fact that the American Institute of Electrical Engineers had already chosen units and names for the more important magnetic quantities, he said, although he had the greatest admiration for American methods and American "Go-aheadedness," he thought they had gone ahead too fast in this matter. For at the International Congress held in their own country in 1893, it was unanimously decided by the chamber of delegates that the C. G. S. system of magnetic units was sufficient for practical requirements. Shortly afterward the American Institute of Electrical Engineers made a communication to the Institution of Electrical Engineers, suggesting names for magnetic units, although the recent Congress said such action was unnecessary. In reply, the Institution of Electrical Engineers, acting in accordance with the decision of the Chicago congress that the time was not yet ripe for selecting practical magnetic units and giving them names, deprecated the proposals made by the American Institute, but in spite of this the names had been given. Under these circumstances he did not think we were bound to accept the names and definitions provisionally adopted on the other side of the Atlantic, especially as the units chosen did not form a consistent system with the volt, ampere and ohm. Dr. Thompson had complained that a "weber," equal to 10 degrees C. G. S. lines, was a unit much too big for practical use. On the other hand, he admitted that, since the Chicago exhibition, the total flux of the largest machines made had increased from 15,000,000 C. G. S. lines to something like 80,000,000. If this rate of increase continued we should soon have machines with total fluxes equal to one or more "webers" (100,000,000 lines), and the objection as to size of unit became of less importance. The adoption of the "farad" as the practical unit of capacity had never been found inconvenient, although it was a unit so huge that no commercial condenser had ever been made, or was ever likely to be made, having a capacity approaching the unit. The submultiple "microfarad" proved quite satisfactory in practice. Surely it was best to have all the practical units of one system. As "farad" caused no difficulty, he did not see why the proposed "weber" should. In Dr. Thompson's opinion the 1881 congress did not change the unit of current so as to make it equal to the C. G. S. unit, because one tenth of that unit was approximately the current taken by glow lamps then used. Being a member of that congress, he (Prof. Ayrton) could say that the true reason for adopting the present ampere was so as not to change the size of the unit then in practical use, for such a change would have caused great inconvenience to the industry. Now, however, Dr. Thompson had suggested a far more radical change in proposing to alter, not merely the size of a unit, but the fundamental character of the equations on

which the C. G. S. system was based. Interesting as the suggested alteration was from a theoretical standpoint, the question to be answered was not what might have been done 30 years ago, but what would be best under present circumstances. He was pleased to hear that Dr. Thompson was at one with the standards committee as regards the definition of the "gauss."

Dr. Frederick Bedell thought it very desirable that national prejudices should not come into the question. He did not wish to take credit for what the Americans had done, nor be held responsible for their sins, but hoped that a satisfactory agreement could be arrived at. The 4π question was not now before the meeting, for they were not quite ready to take it up yet. He might, however, mention that the question was analogous to whether unit cube, or a sphere of unit radius should be taken as the unit of volume. Referring to magnetic units, he said that in the equation

$$\text{induction} = \frac{\text{magnetomotive force}}{\text{reluctance}},$$

the American Institute of Electrical Engineers used the C. G. S. units with names, thus:

$$\text{webers} = \frac{\text{gilberts}}{\text{oersteds}},$$

whilst Prof. Thompson would employ the same quantities with different names, viz:

$$\text{webers} = \frac{\text{gauss}}{\text{units of reluctance}}.$$

The proposal of the committee was to use a large unit of magnetic flux and call it a weber, and choose the unit of reluctance so that the latter equation held good. The suggestions made by the American Institute were the same as those of Prof. Thompson except as to names. In America "gauss" had been used as the unit of flux density, *i. e.*, webers per square centimetre. In conclusion, Dr. Bedell said he endorsed Prof. Thompson's views, for the units he proposed were best suited in size for practical purposes.

Dr. Johnstone Stoney dissented, as a member of the committee, from the proposal of the committee to give such names as weber or gauss to any other than units of the ohm series. He proposed that the committee should pick out those decimal multiples and submultiples of the ohm series of units which were most convenient in practice, and give them such names as gaussane or gaussette, reserving names such as gauss for the units of the ohm series. The suggested affixes with slight modification of spelling would answer in German, French and English; and if in any other language *-et* or *-ane* were unsuitable, other affixes consonant with the genius of the language might be substituted without risk of misunderstanding.

Prof. Perry agreed with the recommendations of the committee, and expressed regret that only the authority of the British Association had been utilized to bring them forward. In his opinion, a general congress should have been called to settle the matter on a satisfactory basis. Six years ago he suggested to the standards committee the units now proposed for adoption, but did not mention names, for these were points on which great difference of opinion might reasonably exist. He was sorry to think that the committee did not boldly face a difficulty which became greater by delay, and adopt at once Mr. Heaviside's suggestions as to rational units. He thought that it was quite possible to make the change now.

Mr. Tremlett Carter said the present system of units was not such as would gain the approval of posterity, and to enlarge that system was not the proper course to pursue. All agreed that the "rational" system proposed by Mr. Heaviside was better, and this should be adopted. It would not be more difficult to do this than to introduce the metric system of weights and measures.

Mr. F. G. Baily said there was no object in hurrying on the christening of the gauss, for he could see no use for it. The ampere-turn was already used in practice. Whether the name "gauss" or ampere-turn be given to the unit was a matter of no importance. Regarding the "weber," the general opinion seemed to favor 10^8 C. G. S. units, Dr. Thompson being the only one who preferred the little weber.

A Step in the Wrong Direction.

According to the New York *World*, Mr. Hawkins, who is said to be a well-known banker and amateur scientist, proposes to supercede the transatlantic telegraph by using the moon as a sort of reflector, and sending an intermittent beam of light from a powerful mirror to the dark surface of the moon, which will then be seen from the other side of the earth; fears are expressed that it may be difficult to make the mirrors large enough.

Monocyclic Voltages.

In the discussion of Prof. Jackson's paper on "A Monocyclic Alternator," read at the Niagara meeting of the American Institute of Electrical Engineers, Mr. C. P. Steinmetz contributed some remarks, which we extract from the current issue of the *Transactions* of the Institute.

Referring to a discrepancy noted in the paper regarding the voltage between the main and teaser collector rings, Mr. Steinmetz stated that as there is a tendency in the alternating-current generator to regulate for constancy of balance factor; consequently in a monocyclic machine, if the main generator coil is loaded, the main voltage will drop more than the teaser voltage, or in other words, since the machine is compounded, the teaser voltage will rise, and thus give a somewhat greater difference of potential between main and teaser coils. Inversely, if the teaser coil is loaded, as by induction motors, its voltage will drop, and so the ratio between teaser voltage and main voltage be reduced. This is plainly shown in the variations of terminal voltages on an induction motor operated from the monocyclic system. In Fig. 1 are the characteristic curves

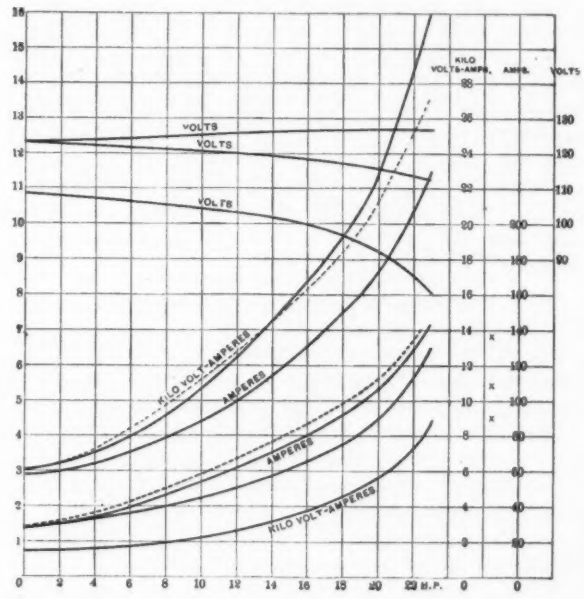


FIG. 1.

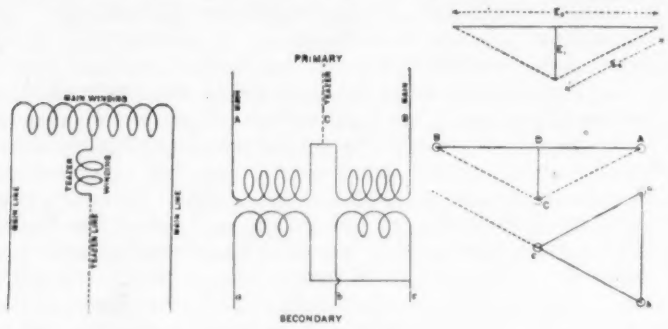
of a standard 15-hp induction motor operated from a monocyclic generator by means of two transformers connected with their primaries between teaser and main line; one of the secondaries is reversed with regard to the other, thereby changing the relative displacement of the E. M. Fs. from approximately 60 degrees in the primary to approximately 120 degrees in the secondary, and giving approximately an equilateral triangle. At no load, the three secondary E. M. Fs. are, as seen from the diagram, 124, 124 and 109 volts, the lowest E. M. F. being that corresponding to the teaser voltage. With increasing load on the motor, and increasing current taken by it, the teaser voltage drops rapidly and reaches 80 volts at 22½ hp, while the two other voltages, which are composite voltages, or resultants of main and teaser voltage, have changed to 127 and 113 volts. The difference between them is due to the interaction of main and teaser circuit caused by the tendency of the generator to maintain its balance factor. On the same curve-sheet are incidentally shown in full lines the amperes consumed by the motor, the large value representing the common return of the two essential single-phase currents. The apparent kilovolt-amperes of the main coil and of the teaser coil are given by two thin full lines. For comparison, in dotted lines are given the amperes and kilovolt-amperes consumed by the same motor when operated on a three-phase circuit.

With regard to the question of the voltage measured between main collector ring and teaser collector ring, this cannot be properly called the teaser voltage, since it is a resultant voltage of the teaser coil and half the main coil. The teaser voltage cannot be measured directly, since only one terminal of the teaser is brought out to a collector ring, while the other terminal is connected to the middle of the main coil, as shown in Fig. 2. Thus, to determine the teaser voltage we can either proceed by calculation by measuring the voltage between teaser collector ring and main collector ring, or E_3, and

the voltage between the main collector rings, or E_1. The teaser voltage is then

$$E_1 = \sqrt{E_2 - \left(\frac{E_0}{2}\right)^2}$$

as seen in the E. M. F. diagram, Fig. 3. Another way to determine the teaser voltage by measurement is to separate it from the main voltage by transformation, by connecting two transformers between the teaser and main lines and reversing the secondary of



FIGS. 2 TO 5.

one transformer, as shown in Fig. 3. We thus get the primary E. M. F. Fig. 5, where $A\ B$ is the main voltage, $C\ D$ the teaser voltage, and $A\ C$ and $B\ C$ the two voltages between the teaser and main coil ; that is, the voltages at the transformers. The reversal of the one transformer reverses one of these E. M. Fs., $B\ C$, and thus gives the secondary E. M. F. diagram, $a\ b\ c$; and in this diagram, which is approximately an equilateral triangle, the smallest side $a\ b$ is equal to twice $C\ D$, that is twice the teaser voltage, times the ratio of transformation. In this way the teaser voltage can be separated by transformation.

The New Woman as a Line-"Man."

We have all read in the comic papers dire warnings of the advent of the new woman and allegations as to how she would invade the domain of the now so-called sterner sex and turn everything topsy-turvy in the labor market. It now appears that, so far as the elecical business is concerned, the new woman has actually arrived. The position to which she at present aspires in the electrical industry seems to be that of lineman, and it was with the electric light company at Bridgeport, Conn., about three weeks ago, and under the name of Charlie Morgan, that she secured her first job.

Sad to relate, while at the top of a pole making some repairs on Thursday of last week, she happened to incidentally touch a trolley wire, and the shock caused her to fall from the pole limp and apparently lifeless. Being taken to the hospital the physicians, in their turn, were shocked to find that she was not of the sex which, from the clothing and the lineman's spurs she wore, they would have supposed she was.

The matron took charge of her, and finding that she was fairly caught she said, as soon as she was sufficiently recovered:

"My name is Minnie Howard Briggs, and I am a professional. I can sing in a chorus and I can do a turn on the trapeze. Last Winter I was with a show, and when it went to pieces I found myself a long way from New York without a cent. I could not get hold of any money. There are only a few things a woman can do to earn a living, and I couldn't do any of them. I can't sew. I can't cook. I can't, or rather I won't, do housework. So I didn't know what to do. Well, I have been for years as much at home in men's clothes as in women's. In fact, I am more used to tights than skirts. A man can always get more than a woman, so I decided to get work as a man."

"But how did you become a lineman?" asked the matron.

"Why, they used electric lights in the circus, and I saw them fixing them, and so I got to know a good deal about it. Then my training on the trapeze had given me the ability to climb about. So you see it was quite natural. I got a job up at Hartford to learn the business, and it was not long before I got on as well as any of them. I have worked in most of the big places in the State."

After two hours "Charles Morgan" was fully recovered except for the burned hand. So she said good-bye to the matron and the nurses and doctors who crowded about her.

"What are you going to do?" asked Dr. Brennan.

"Oh, I've got to leave town," she said, laughing and shrugging her shoulders. "I'm caught. They'll discharge me if I don't quit. But there are plenty of other places. I'll just move on. I like the life and I'm going to stick to it."

The Exact Measurement of Voltage, Current and Resistance.

BY W. M. STINE.

An article by Mr. C. J. Black bearing this title appeared in THE ELECTRICAL WORLD of Aug. 17. It contained a further reference to an abstract, in the Digest for July 20, of the "double loop" method employed by Mr. Thiermann for measuring high E. M. Fs. by the use of the standard cell. Mr. Black illustrated with a sketch a method which he devised and named in contrast, the "single loop" method. This latter method contained a serious error which has seemingly passed unnoted. The London *Electrical Review* of Sept. 6 reprinted Mr. Black's article entire, with no corrections. The matter might be passed over without further comment did it not involve a method for the measurement of current and E. M. F. of the highest value to engineers. In this case the method was wholly original with Mr. Black, who, strange to say, did not know of the potentiometer and its use until his attention was called to it by the writer.

The "double loop" devised by Mr. Thiermann is a needlessly complicated arrangement of circuits. It involves the use of numerous coils of accurately standardized high resistance and the unnecessary condition of keeping the standard cell on a closed circuit.

Mr. Black's diagram is reproduced in Fig. 1; it will be noticed that

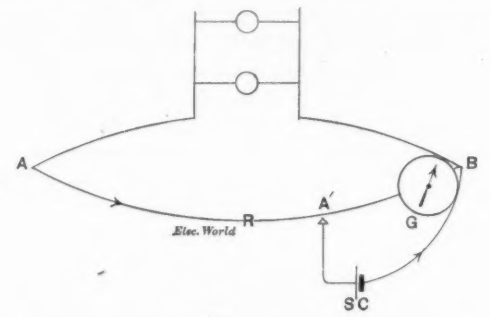


FIG. 1.

the galvanometer is placed in the circuit $A\ B$, this being the circuit over which the fall of potential is to be measured. No account has been made of the resistance of the galvanometer, which in this case is an integral part of the circuit. If the resistance of this galvanometer is very low it is possible to so adjust the varying resistances that no current shall flow through it, providing the internal resistance of the cell is also very low, a condition which obviously does not obtain in cells of this type. All the current passing over R must then flow through the standard cell, which would not only ruin the cell but render its readings wholly valueless. In order to determine the P. D. between A and B the internal resistance of the cell must be known as well as its E. M. F. A millivoltmeter in shunt to $A'\ B$ would yield far more accurate results.

The correct method is shown in Fig. 2, which exhibits the familiar

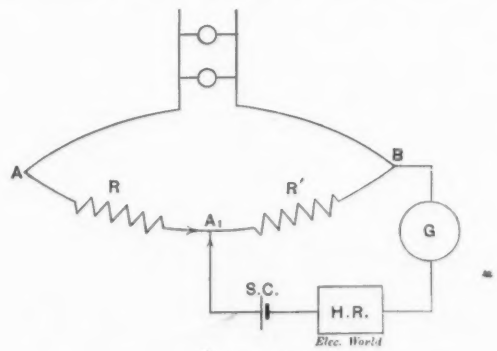


FIG. 2.

potentiometer scheme in common laboratory use. The contact at A' is moved along the resistance R, until a resistance R' has been found over which the P. D. is the same as the opposed E. M. F. of the standard cell, viz.; 1.44 volts for a Carhart-Clark cell. When this equilibrium is reached, the galvanometer shows no deflection. The value of this method lies in the fact that it is a zero-deflection one. Calling the P. D. over $A\ B$, E, and the E. M. F. of the standard cell, E'; then R being the total resistance between A and B,

$$E = \frac{E'\ R}{R'},$$

The standard cell must in all cases be so connected up that its E. M. F. opposes the direction of the current over $A\,B$, as shown. It should also have in series with it a high resistance, $H\,R$, of at least 10,000 ohms. Since no current flows over this circuit when the adjustment is completed, its total resistance is without any influence on the results.

The geometrical illustration of Fig. 3 may make this method

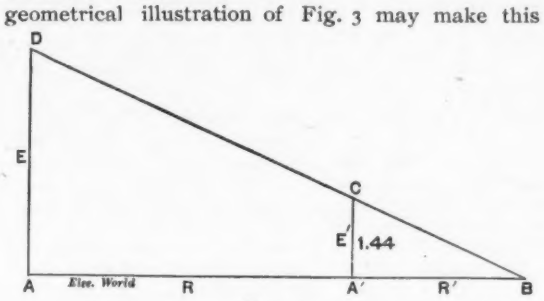


FIG. 3.

clearer. The resistance, R, is laid off on the line $A\,B$, representing the total resistance of the circuit over which the fall of potential is to be measured. $A'B$ is then laid off equal to R'. The perpendicular line, E, is drawn at A', to represent the E. M. F. of the standard cell. A line is then drawn through C, cutting the perpendicular erected at A, in a point D. Call $A\,D$, E. The two triangles, $A'\,B\,C$ and $A\,B\,D$ being similar,

$$\frac{E}{E'} = \frac{R}{R'} \qquad \text{and} \qquad E = \frac{E'R}{R'}.$$

The potentiometer method is an exceedingly valuable one, and should be thoroughly understood by electrical engineers. By suitable modifications it may be employed for accurately measuring a great range of potential differences and currents. It is also a most excellent method for measuring very low resistances. In practice a specially designed resistance box, called a potentiometer, is employed. A number of modifications of the potentiometer were fully described in a recent paper and its discussion before the American Institute of Electrical Engineers.[1]

The Michigan State Street Railway Association.

The Fall convention of the Michigan State Street Railway Association recently held at Grand Rapids, Mich., for the most part devoted itself to an informal discussion of the legislation likely to affect the street railway companies of the State. No papers of a technical character were presented. One of the topics considered was the vestibule law passed at the last session of the legislature. This measure is similar to the law which was adopted in Minnesota, but it does not define the kind of material to be used in the construction of the storm front. Most of the members seemed to favor compliance with the spirit as well as with the letter of the law, as it was said that the winters in Michigan were unusually severe, and that in cold weather motormen needed some kind of protection while performing their duties. It is stated that most of the companies in the State will comply with the law fully 60 days before Jan. 1, when its provisions go into effect. Some of the companies have already attached vestibules to their cars. W. Worth Bean, of the St. Joseph & Benton electric line, stated that he had equipped his cars with vestibules even before the passage of the bill.

The three-cent fare bill introduced at the last session of the legislature was also a topic which interested the members of the Association. The measure was killed in committee as well as the bills which provided for the taxation of the franchises of electric light, electric railway and gas companies. The members of the Association claim that passengers can not be transported, roadbed and electrical apparatus maintained, fair wages paid to employees, 6 per cent. paid on the investment, cars vestibuled and heated by electricity in Winter, open cars provided for the Summer months, and amusements arranged for the enjoyment of the public, unless five-cent fares, with transfers at reasonable distances, can be collected.

In view of the fact that so many important legislative matters relating to street railways are being generally discussed, and as it was desired that a full expression of opinion of the members in regard to probable legislation should be obtained, it was decided to adjourn the meeting until Dec. 4 next. The present officers of the Association will retain their positions until that time, as follows: President, W. L. Jenks, Port Huron; vice-president, W. Worth Bean, St. Joseph; secretary and treasurer, B. S. Hanchett, Jr., Grand Rapids.

[2] Transactions of the A. I. E. E., Vol. XI, pp. 476 and 786.

The Invention of the Electromagnetic Telegraph.—VI.

BY JAS. D. REID.*

The year 1837 was remarkable for an increase and increasing interest in electromagnetism and telegraphic plans and devices. The signal or semaphore systems, as distinguished from the record-making telegraph, had come into use in many parts of Europe. The cause of this was attributed to the better knowledge of the voltaic or dynamic batteries which gave the prophecy of a new and valuable motive power.

The volta pile was contrived in 1800, but its power and value remained long dormant and little known. The chemical effects of this pile suggested the idea of electrical communication by the employment of the decomposing action of voltaic electricity. In 1811 Sœmmering tried it, but without any valuable result. In 1819 Oersted made the grand discovery that the needle deflected when in presence of the voltaic current. Schweigger made the discovery that the magnetic effect of the current was increased by repeating the primary element. Arago and Davy, in 1820, observed the attraction of iron filings by a conducting wire. In 1827 Ohm formulated the valuable laws of resistance which bear his name. In 1825 Sturgeon made the first horseshoe magnet. In 1831 Henry greatly advanced the knowledge of electromagnetism. He showed to his class the great lifting power of the electromagnet. He also, some time afterward, aided telegraph development by proving Schweigger's discovery of the increase of power in a battery by the multiplication of the primary element. All these developments, long confined to the knowledge of the schools and class rooms of colleges, were now coming into wider knowledge and notice. The most useful of all these to Prof. Morse, who had been thoroughly posted in electromagnetism and cognate topics under Silliman, Dana and Renwick, was the advent of the dynamic batteries of Daniell, Smee and Graves. They gave what he needed, a steady, decided and prolonged current, which his own imperfect Cruikshank battery had failed fully to provide. With the Daniell battery the record upon the paper of his model register was now easily rendered continuous, and three elements of dot, dash and space, as devised by Mr. Morse, December, 1832, but for some time difficult to form because of imperfect battery elements, became now easy of formation and met all possible requirements.

The record of Prof. Morse respecting this alphabet is as follows:

"The general features of the first automatic process may be briefly stated as follows:

"1. The embodiment in a species of type of the numerals to be recorded, consisting of lines, dots and spaces, the elements of the Morse Code. This was accomplished in November and December, 1832. Subsequently the inventor extended the principles of his code to the letters of the alphabet which were added to the numerals, and, with some special signs for punctuations and office signals, completed his original code."

This statement from a man of Morse's high character, should forever stand impregnable and unimpeached.

On Sept. 2, 1837, Mr. Morse gave another exhibition of his instrument to a large and distinguished audience. It had still all the crude features as when exhibited in 1835. But various minor features had been improved, and the work done was accomplished with greatly increased facility and exactness. The features given to it in 1832 on the ship *Sully* were, practically, unchanged. These were:

(1) An electromagnet; (2) a lever with recording pencil at one end, and armature to receive the action of the magnet; (3) clockwork actuating rollers to move paper steadily in front of the pencil or pen; (4) the alphabet of dots and lines.

It now proved its ability:

1. To make a visible and easily interpreted record by the hand, or automatically, by types.

2. To give, acoustically, sounds easily distinguished and read by the ear.

3. Even without sight or sound, its pulses could be felt and interpreted.

4. It could then, as it has often, under curious circumstances, done since then, reveal its message to the taste.

It needed now to be placed in the hands of an intelligent mechanician to fit it for public employment.

Among those present at this exhibition were Prof. Daubeny, of Oxford University; Prof. Torrey and Alfred Vail, son of Judge Vail, proprietor of the iron works of Speedwell, N. J.; all of whom con-

[1] Mr. Reid's article forms part of the contribution of Mr. E. L. Morse, the concluding portion of which will be printed next week.

gratulated Mr. Morse on the decided success of the exhibition. It was then that Alfred Vail was so much impressed by what he had seen that he invited Mr. Morse to come to his father's house, and assured him that facilities would be given him to have the apparatus put in suitable condition for public use, and under Mr. Morse's own direction. Mr. Morse accepted the invitation, and in the following month went to Speedwell, and for several weeks made Judge Vail's house his home. It was characteristic of Mr. Morse's refined nature that, in return for the hospitality thus shown him, he painted, when not occupied with the new register, the portraits of the family.

Alfred Vail was, at this time, a young man, and, so far as appears, without any special engagement of any kind. He was not a practical mechanician, as many have supposed, except as he had become familiar with the work of the machine shop of his father's extensive foundry. The tools there were mostly adapted to the heavy and coarse work of such an establishment, which seemed to be a very unlikely place to secure fine mechanical work. But the conditions suited Mr. Morse's circumstances. Alfred Vail and he began there a friendship which never was afterward weakened or broken. Mr. Vail, who was hampered with no other engagement, gave himself up to Mr. Morse's guidance, and thus these two men, in many respects utterly unlike, together commenced to dress the baby telegraph register in proper garments, so as to be ready to face a larger public scrutiny and use. And so it was that on Jan. 6, 1838, after the erection at Speedwell of an improvised circuit of three miles, the new machinery, as so far finished, was put in use, and messages were sent and received over it to Judge Vail's great delight and satisfaction as well as to that of his son, Hon. George Vail, M. C., who was also witness to this critical test of a new wonder.

Such is the exact record of the building of the first register respecting which Stephen Vail, son of Alfred, 50 years thereafter wrote to the *New York Tribune* in April, 1892, as follows :

"My father, Alfred Vail, took from Morse's hands his crude wooden apparatus, which would not work with any practical success, and, unable to make it any better, threw it aside, and then, alone and unaided by Morse or any one else, devised an alphabet, and the mechanism to make that alphabet of use—the so-called 'Morse Alphabet,' and the so-called 'Morse Recording Receiver'!"

It required the lapse of 50 years and public forgetfulness and ignorance to make possible a statement so absolutely absurd and false.

George Vail was a shrewd, money-making man. He was quick to see the money value of the invention and at once proposed to purchase an interest in it. Before doing so, however, he required proof of the power to transmit language to great distances. This had been one of Prof. Morse's earliest sources of anxiety. As early, however, as 1836 he had found a simple method of solving the difficulty. He was not ignorant of the fact of the reduction of the power of the current by distance, but, as he said to his friend, Dr. Gale, "Give me, at the end of 10 miles, a current only strong enough to move a lever, and I will send a message round the world." On explaining this to Mr. Vail all doubt was dispelled, and it was determined that patents should be secured, and another exhibition be had in New York. On Jan. 24, 1838, therefore, another and very successful exhibition was held in New York. On Feb. 8, on an invitation from the Society of Arts and Science, Philadelphia, an exhibition was given in that city which excited so much interest that resolutions were adopted urging Congressional aid. It was then exhibited, Feb. 21, before the president and cabinet in Washington, all of whom were greatly interested, and gave very decided encouragement to Mr. Morse to press it into use. Mr. Vail aided in all these exhibitions and was of great service at them all.

After this last exhibition Mr. Morse returned to New York to take up his neglected duties, and Mr. Vail returned to Speedwell to complete the work on the register. Mr. Vail arrived at Speedwell April 7, and April 18 wrote Mr. Morse as follows :

"Dear Mr. Morse: Since my return I have been very busily engaged in finishing the machine. I have been entirely 'non plus' with the battery, and how to remedy the evil I know not, so I resolved to send it to you together with the machine. I have not been able to adjust the marking, that is, to make the dots and lines which make the letter more distinct. I shall be happy to learn from you the cause of my difficulty. A. Vail."

This letter of Mr. Vail's seems to show clearly enough that he depended upon Mr. Morse for guidance in his work, and seems to show his ignorance of electrics. No one could surely use this letter, after the narrative I have given, to claim for Mr. Vail the invention of the Morse alphabet. It is time that all these foolish claims should be abandoned. I knew Mr. Vail long and intimately. It was to him I first went when I was first charged with executive telegraph duties. But I never heard him at any time give the least hint that the alphabet was the work of any one but Morse. We once endeavored to persuade Mr. Morse to change the places of some of the spaced letters, *r c e o*, etc., but became satisfied that the changes were not desirable.

Stephen Vail has put on record the following claim made by his father, but which, so far as I know, was never, except in one item of it, made during his life, and that only, so far as I know, to myself. The following is the claim:

"This lever and roller were invented by me in the sixth story of the *New York Observer* office (Morse Building) in 1844, before we put up the telegraph line between Washington and Baltimore, and the same has always been used in Morse instruments. I am the sole and only inventor of this mode of telegraph embossed writing. Prof. Morse gave me no clue to it, nor did any one else, and I have not asserted publicly my right as first and sole inventor because I wished to preserve the peaceful unity of the invention and because I could not, according to my contract with Prof. Morse, have gotten a patent for it."

This claim, as worded above, which only came to light after the death of both Morse and Vail, could never have been made in Prof. Morse's lifetime without protest. The lever and roller of the Morse register had their origin in the original conception of Morse, as is fully proved by the sketches made,by him on the *Sully*. These two things—the lever and the roller, the one for the forward movement of the paper, and the other for receiving power and impressing the record—were the necessities of and the elementary origin of the whole invention. The proofs of their origin by Morse, so clear and unchallengeable, should have made such a claim by Mr. Vail impossible. I am satisfied, however, that it had another design, and which, had it been expressed within its proper limitations, would have had its proper acknowledgment and value. By the year 1844 the Morse patent became the property of four parties. These were Prof. Morse, Dr. S. D. Gale, Alfred Vail and F. O. J. Smith. To Mr. Vail was assigned one quarter in consideration of the value of his early aid, and because to him was assigned all questions of mechanical detail. The chief reason for this grant, as I learned only from himself while aiding him in opening the office at Philadelphia, was that he had introduced into the register what Mr. Morse called the *point seche*, or steel stylus, for embossing the record on the paper, and that that feature of the register was his own. I have no desire to doubt it. It was for many years a very useful and valuable method of record, and although now almost wholly out of use, may yet, if Mr. Morse's idea of its possible use for automatic purposes ever be realized, prove of still greater value. The steel point thus introduced into the register made, by the aid of a small groove in the roller, a record similar to that made of letters for the blind, and dispensed with the inking and pencil processes formerly used. To all intents and purposes, therefore, he practically did patent his invention of the embossing stylus, and received compensation therefor. He himself never complained that it was not sufficient.

The following is Mr. Morse's idea of its possible use in automatic work which may, before long, assume new importance:

"This mode [embossing] requires no new instrument for the preparation of the paper, no new method of punching paper to be learned by the operators. The operator prepares the dispatch in the usual way by embossing the paper, as if sending a dispatch. It is then at once ready for transmission. The paper strip, with the embossed characters, is then simply passed beneath a delicate lever like that of a relay magnet. The result would be the same as by the type and punched paper process."

I believe, as Mr. Morse did, and as experience is proving, that the future history of the telegraph will demand more largely than now the aid of simple automatic processes.

One thing which I am compelled to say after reading Mr. Vail's posthumous claim is this: Having taken the pains to leave this particular claim on record, it must be presumed that he, in so doing, exhausted his claims. Mr. Vail remained in Washington until 1848 variously occupied. In the Fall of that year he wrote Mr. Morse as follows:

"Washington, Sept. 21, 1848.

"Friend Morse: The Washington andNew Orleans Co. is, at last, organized. And what do you think they have done with me. Supt. of Washington and N. O. line all the way from Wash. to Columbia at $900 !!!!!!!! This game will not be played long. I have made up my mind to leave the telegraph take care of itself since it cannot take care of me. I shall in a few months leave Wash. for N. Jersey—family—kit—and all, and bid adieu to the subject of the telegraph for some more profitable business."

The truth is Mr. Vail had no natural aptitude for executive work, and he had a temper somewhat variable and unhappy. He and I

got along very well together until I determined to order my own instruments, his being too heavy and too difficult, as I thought, for an operator to handle while receiving. We had our instruments made by the same maker—Clark & Co., Philadelphia. Yet even that did not greatly separate us, and we were always friends. About some things his notions were very crude. It was under his guidance that David Brooks, Henry C. Hepburn and I, in 1845 undertook to insulate the line from Lancaster to Harrisburg, Pa., by saturating bits of cotton cloth in beeswax and wrapping them round projecting arms. The bees enjoyed it greatly, but it spoiled our work. But I have no desire to criticise him. He seemed to me to have great opportunities, which he did not use. He might have had, I thought, the register work of the country, and secured a large business. But it went from him to others, and so he left the field. The following letter he wrote to Mr. Morse on his return to Morristown:

"MORRISTOWN, N. J.

"MY DEAR PROFESSOR: The great expectation I had on my return home of going into partnership with my brother George, founded on promises made by my father, have burst. I feel, Prof. Morse, that if I am ever worth anything, it will be wholly attributable to your kindness. I should have now no hope or earthly prospect of happiness and domestic bliss had it not been for what you have done for me, which I will ever remember with the liveliest emotions of gratitude.

"A. VAIL."

Does language like this sound like the words of a man who had thrown away the fruits of his brain on a man who "had robbed him of his rights and fame"?

In a letter written to Mr. Vail by Mr. Morse a few years afterward, referring to a letter received from Mr. Vail, he says:

"You say you hope I shall not forget that we have spent many hours together. You might have added 'happy hours.' I have tried you, dear Vail, as a friend, and think I know you as a zealous and honest one. S. F. B. MORSE."

The last letter from Vail in my possession, dated Morristown, N. J., Oct. 2, 1855, is of a private character, and concludes as follows: "I shall be highly pleased to learn that in all your trials and difficulties Providence is bearing you up and protecting your rights."

This had reference to certain attacks on Morse's claims then before the courts. Mr. Morse spoke and wrote kindly of Mr. Vail to the last. The last public testimony given by the professor to his old and trusted associate and friend was at the great banquet given to Mr. Morse in New York in 1871, when a large gathering of New York's most distinguished citizens, presided over by Hon. Salmon P. Chase, assembled to do him honor. Mr. Morse's reference to Mr. Vail and the honorable service he had rendered in the introduction of the telegraph brought from his son the following manly letter:

"N. YORK, June 13, 1871.

"*Professor Saml. F. B. Morse.*

RESPECTED SIR: Allow me for myself to thank you for the kind and generous manner in which you alluded to my father's share in your early labors and struggles during the babyhood of the now giant telegraph.

"I have always felt that you would fully recognize and acknowledge his assistance, and it was therefore exceedingly gratifying to me when, being absent when you spoke them, I read your speech in the published account of Saturday evening's banquet in your honor.

"Accept many wishes for your continued health and honors, and believe me, Yours with great respect, J. CUMMINGS VAIL."

In view of the many absurd reflections upon Mr. Morse for his alleged neglect and ignoring of Alfred Vail, that manly letter is refreshing and welcome.

One word more. This paper has for its chief object the clearing up of the status of the Morse telegraph at the time of its exhibition in 1837, before Morse found aid and resources from outside. The sharp eye of the courts have fortunately seized on 1837 as the decisive date of supreme proof of its legal status. Here is the decision rendered:

"From that time forward (1832) Morse is entitled to the high credit of making attempts to construct a practical machine for practical, popular and commercial use, which would communicate to a distance by electromagnetism and record quickly and cheaply what was communicated, however imperfectly informed he may then have been of what had already been accomplished toward it, and he has the still higher credit among the experimenters of that time to 1837 of having then succeeded in perfecting what he describes at that time in his caveat and specification. Among about 62 competitors to the discovery of the telegraph by 1838, Morse alone, in 1837, seems to have reached the most perfect result desirable for public and practical use. By a lever deflected by a magnet, provided with a pen to write, with machinery to keep paper moving, so as to inscribe dots and lines, and more especially with an alphabet, he accomplished the great desideratum. Thus the fortunate idea was, at last, formed and announced which enabled the dead machine to move and to speak intelligibly, at any distance, with lightning speed."

Stronger evidence could not be given that before Morse met Alfred Vail his system of electric telegraph had been fully elaborated and was practically complete.

I cannot close this paper without reference to Mr. Pope's article in the *Century*, in 1888, upon which so much of the contentions to which I have referred have been based. Mr. Pope writes as follows:

"Not a single feature of the original invention of Morse as formulated in his caveat and repeated in his original patent, is to be found among the essential constituents of the wooden apparatus. Prior to 1837 it embodied the work of Morse and of Henry alone. From 1837 to 1844 it was a construction of the inventions of Morse, Henry and Vail; but . . . the elements contributed by Morse have gradually fallen into desuetude, so that the essential telegraph of to-day, and the universal telegraph of the future, comprise the sole work of Joseph Henry and Alfred Vail. The grandeur of Vail's conception of an alphabetical code, based on the elements of time and space, has never met the appreciation which it deserves."

After reading such a statement, Mr. Stephen Vail may be excused for all he has written. The association of the name of Henry with Morse, 1832 to 1835, is based on the fact that Henry in 1832, by aid of a permanent magnet and a current of electricity through a mile of wire, rang a bell. The first publication of this was in 1857, so that, allowing to it all the significance possible, it had no relation to Morse and his peculiar work in that same year. Even had it been known in 1832, the record would have been, "Henry rang a bell a mile away," and of Morse it would have been written: "By the combination of an electromagnet, recording lever and pencil, Morse arranged a system of recording language on a moving surface of paper in an alphabet of dots and lines." It pleased Prof. Mayer, when telegraphs became common to the world, and to illustrate the astuteness of his own knowledge, to call Henry's bell the first electromagnetic telegraph, which, etymologically, was no telegraph at all, but a simple experiment, by no means new, of electromagnetic effect to a class of students. Dana and Moll and Day and Silliman had given similar and equally suggestive exhibitions of electromagnetic power. Henry's bell was only one of many similar illustrations in Europe. It was an experiment which, in Henry's mind, bore no fruit in invention. It was, it may be admitted, full of suggestion, but it did not diminish, and in honor should never have been used to diminish, the true value of Morse's practical idea and claim with its completeness of detail and perfected methods so far as these were capable of delineation. The language of the Supreme Court was: "The evidence is full and clear that when he, Morse, was returning from Europe in 1832, he was deeply engaged upon this subject during the voyage, and that the processes and means were so far developed and arranged in his own mind that he was confident of ultimate success."

Prof. Henry, writing to Prof. Morse, May 6, 1839, says:

"I am acquainted with no fact which would lead me to suppose that the project of the electric telegraph is impracticable. But what form of apparatus, or what application of the power will prove best, can, I believe, only be determined by careful experiment. I can say, however, that so far as I am acquainted with the minutiæ of your plan, I see no practical difficulty in the way of its application for comparatively short distances."

And yet, in the face of Henry's own statement of the limitations of electrical transmission, and apparently in utter ignorance of Morse's delay to overcome the difficulty, Chief Justice Chase, both as opposing counsel in the case of Morse *v.* O'Reilly, at Frankfort, Ky., and at the banquet given in honor of Prof. Morse, New York, Dec. 30, 1868, and over which he presided, referred to Henry as he "who first showed the practicability of producing electromagnetic effects by means of the galvanic current at distances indefinitely great." Others, in attempting to minify Morse, claimed that Henry virtually invented the electromagnetic telegraph in 1831. And yet in 1839 Henry himself, after experiments with Morse's own wire, acknowledges "that he had no idea of *the form of such a telegraph*, and supposed there were *still difficulties which it would require ingenuity and enterprise to overcome.*'" In all this frankness Henry showed himself greater than his friends.

A few years later Prof. Henry wrote Morse again.

"PRINCETON, February 24, 1842.

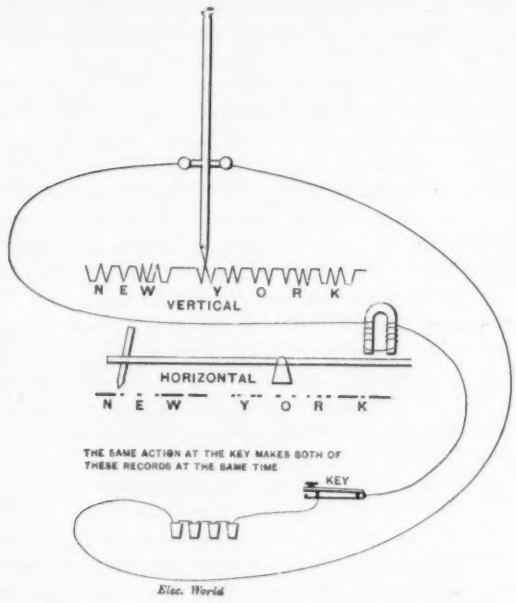
"DEAR PROFESSOR MORSE: About the same time with yourself, Prof. Wheatstone, of London, and Prof. Steinheil, of Germany, proposed plans of electromagnetic telegraphs. These differ as much from yours as the common principle would well permit. Unless some essential improvements have lately been made in the European plans I should prefer the one invented by yourself. With very best wishes for your success, I remain yours, with much esteem,

"JOSEPH HENRY."

After what I have stated, and with these letters before me, I think I have the right to say that the association of Henry's name honored as it always has been and is, with the Morse telegraph, has no basis of fact to justify it. What Prof. Henry calls Morse's, Mr. Pope has no right, by any code known to honorable men, to call Henry's.

As to what Mr. Pope is pleased to call the "grandeur of Mr. Vail's conception of an alphabetical code based on the elements of time and space," the assertion of which, as the invention of Alfred Vail, is based on the memory of a boy of 15, after the lapse of 50 years I have this to say.

Mr. Morse's original plan of record, as is evident from his sketch book, was by a horizontal lever with a pencil recorder, which required an alphabet of dots and lines, "based on the elements of time and space," and which was the only possible mode of record by such an instrumentality. But there was this difficulty, that when the lever worked horizontally, the pencil point was apt to break, and which, in an exhibition, was, of course, very embarrassing, and to be avoided. To remedy this in his model, which was made of wood and merely for exhibitionary purposes, he suspended the lever in such a way that


N E W Y O R K
VERTICAL
HORIZONTAL
N E W Y O R K
THE SAME ACTION AT THE KEY MAKES BOTH OF THESE RECORDS AT THE SAME TIME
KEY
Elec. World

Vertical and Horizontal Lever Methods.

the pencil point rested continuously on the paper and traced a continuous line as in the Atlantic cable syphon lines, and showing the dots and dashes and spaces, not by broken signals, as with the horizontal lever, but by equivolently diverging lines, which showed, however, with equal clearness in V and LN shapes, the letters transmitted. So, when Mr. Morse decided when at Speedwell to restore the original method of a horizontal lever in the new instrument to be now made, and to lay aside the port rules for the simple key, this boy Baxter thought that Mr. Vail was inventing a new alphabet, as he saw the dots and lines recorded on the moving paper, instead of the V shapes of the wooden model, but which was in fact only the first plan restored—and the alphabet unchanged. This is evident even in Mr. Pope's narrative. With such a claim now made on this boy's testimony, and given with words of so glowing eulogy, one wonders what alphabet Mr. Morse could have used when, a few days before, messages were sent and received by the distinguished audience in the rooms of the New York University, New York, in the presence of Mr. Vail himself, and to his own great delight.

What Baxter saw was the change from the vertical method of the exhibitionary model to the horizontal method of the plan of 1832, as sketched above, so that what Baxter saw in dots and lines was only the original method, but produced by the very same manipulation as the other.

Mr. Pope knows, if any one does, that in Morse's earliest signals to indicate numerals, dots and dashes were his only resource, and to indicate the members of the alphabet, as done in December, 1832, he had, and could have, no other resource. He knew that the vertical and horizontal movements of the lever were exactly alike. He knows, or ought to know, that all that remains of the telegraph to-day is the *lever of 1832, the Morse alphabet of 1832*, the acoustic sound of all the forms then and since, and the relay magnet; and the only things that have gone into "desuetude" is the steel pen, which Mr. Vail claimed as his own, and the rollers and rolling paper of 1832.

It seems passing strange that the illusion of a mere boy, looking on a mechanism whose history and meaning were unknown to him, should be used to take from an inventor of a grand new art which now holds the world together, and is to be one of the grand instrumentalities of inaugurating peace on earth and good will to men, the very basis and necessity of his invention, to give it to a man who never claimed it by word or pen to any living man, and of which in the matter of invention there is not, on behalf of Alfred Vail, any reliable living or testamentary proof. One word more. If George Vail, who was greedy of money, and who begged Morse for a share in his ripened fame, as having, by the investment of $2,000, saved it from oblivion; had George Vail known, as, if true, he must have known, that his moneyless and dependent brother had invented the very heart and vital centre of the telegraph, he would have then, and there, bound Morse hand and foot, and had for George Vail, M. C., the last pound of flesh and the last ounce of blood.

I add, without comment, the following copies of letters by George and Alfred Vail:

"Speedwell, Jan. 5, 1838.

"Dear Mr. Morse: One object I had to write you was to bear with Alfred, which I have no doubt you will do. *He is easily vexed.* Also that *I may have a place in your mind*, and that you may meet with that success which you deserve. George Vail."

"Speedwell Iron Works, Feb. 22, 1845.

"Alfred Vail: I am, for one, unwilling to let it [the telegraph] linger along until the novelty of the thing is worn off. Do get something like an appropriation for the purchase inserted by the committee of ways and means in their bill. Is F. O. J. Smith with you? If so, what in the name of common sense is he doing that an appropriation is not called for? George Vail."

"Morristown, Dec. 19, 1849.

"Dear Mr. Morse: Enclosed I hand you a paragraph cut from the Newark *Daily* of the 17th inst., drawn out by an article I addressed to the editor. I now suggest that we give a temperate article on the rise and progress of telegraphs, asserting claims for yourself, and, as I must father the article, give the Vails and New Jersey all the 'sodder' they are entitled to, and a little more if you can spare it. George Vail."

Of Mr. Alfred Vail as an electrician I give the following:

"Washington, Sept. 9, 1846.

"Dear Morse: I have just tried an experiment upon unsoldered joints of copper wire. I cut up into 1,000 pieces copper wire. Every joint was made by twisting the end of one wire around the body of the other with the pincers, and the contact made perfect and clean, in length about 150 feet. This morning I tested it by putting the wire into the circuit from here to Baltimore. And what do you think was the result? Give a guess before I tell you. The galvanometer stood the same with the 1,000 joints as it did when out of the circuit! I am much surprised, but so it is. A. Vail."

That is, he expected that the addition of 150 feet of copper wire into a circuit of 40 miles would cause some decided effect on the galvanometer.

He adds:

"I understood that the postmaster-general would like to continue the telegraph but for the heavy salaries (my thumb upon my nose)."

Much interesting history might be added, but as it would make no clearer the facts aimed at, although deeply interesting as an exhibition of noble struggle of a true soul whe believed that "who his great purpose yields, he is the only villain in the world," I close the paper, thankful that I am allowed still to bear testimony to the genuine greatness of a man who, I think, loved me, and who I deeply and very tenderly loved and revered. James A. Reid.

Dunfermline, Scotland, July 29, 1895.

(The concluding portion Mr. Morse's article will appear next week.)

The Parsons Turbine.

It has been officially announced that the Westinghouse Electric & Manufacturing Company has purchased the exclusive rights for the United States of the Parsons steam turbine. The report that the Westinghouse Company has interested itself in the Tesla oscillator is, we learn, unfounded.

Telephone Facilities in the Baltic Sea.

The best telephone facilities possessed by any city in the world are enjoyed by Mariehamn, the capital of the Aland Island, in the middle of the Baltic Sea, in which there is an exchange telephone for every 13 inhabitants.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

BY CARL HERING

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS

LIGHTS AND LIGHTING.

Swan Incandescent Lamp Patent.—The Lond. "Elec.," Sept. 20, stated that on the 29th of October the British patent No. 4,302 of 1881 will expire; it gives a brief abstract of the patent, which refers to welding together the ends of a filament and the leading-in wires, by means of a deposit of hard carbon.

Inverted Arc Lamp.—A brief, illustrated description of such a lamp for interior illumination, is published in Lond. "Engineering," Sept. 20.

Tests of European Incandescent Lamps.—"El'ty," Oct. 2, publishes a full page table giving the results of life tests, made by Mr. Paisley, of lamps of 17 European makers, all of 100 volts, some of 16 and some of 8 cp; they were purchased in the open market; the readings were taken weekly, and are given for a beginning of the run, at 350 hours and at 600 hours.

Arc Lamp.—A number of illustrations of the different forms of the Bardon (French) lamp, taken from "L'Elec.," July 27, are reprinted with a brief description in the "West. Elec.," Oct. 25; some of the illustrations are diagrammatic; some of the lamps are for constant potential and others for constant currents.

POWER AND HEAT.

Worm Gearing.—In the "Elek. Zeit.," Sept. 19, Mr. Egger replies to the recent criticism of Mr. Kolben (see Digest, Sept. 14). He limits himself to showing that a speed of 600 revolutions has proved to be the best for passenger elevators; a certain firm in Vienna which has installed about 100 of these, at first tried a hi her speed but came back to this one; the efficiency is not the most important feature in elevators which consume very little energy; one of the most important features is that it shall run quietly and smoothly; as in many places the space for the machinery is very limited, it is often necessary to suspend the motor and drum from the inside of the roof, as was done in many installations; with a reduced speed the drum may be given a larger diameter increasing the life of the cables; a speed of 600 was in most cases found to be the best and it is also the one used by the Otis Company.

Hydraulic-Electric Transmission System.—"L'Eclairage Elec.," Sept. 14, reports that the Van Rysselberghe system, which was used at Antwerp, has turned out to be a complete failure both from a financial and from an engineering standpoint; no specific reasons are given. The system was described in the Digest, Oct. 7, 1893; Feb. 24, April 14, 1894, and consists in general in distributing power hydraulically to sub-stations and there transforming it into electric energy for local distribution, the claim being that it is cheaper to distribute the power to the sub-stations hydraulically than electrically. In conclusion the note says that electric distribution pure and simple has nothing to fear from the competition of hybrid systems.

Two-phase Plant at Anderson, S. C.—A brief, illustrated description of this plant, in which Stanley machinery is used, is given in the "Elec. Eng.," Oct. 2, and it is said to be the first plant in the South for long-distance electric transmission; the distance appears to be 6 miles. The plant consists of a two-phase 150-kw alternator generating 5,500 volts directly, and it is thought to be the only machine of its size in this country having so high a voltage; it contains no moving wire or brushes and regulates automatically; in the city the voltage is reduced to 1,040 at which it is distributed; the loss in the long-distance line of 3.5 per cent.; the current is used for incandescent and arc lamps, and motors.

Transmission Plant at Winnipeg.—The "Eng. News," Oct. 3, announces that a transmission plant is proposed, to utilize the water-power of the Winnipeg River at Keewatin, Ont., and transmit electrically 40,000 hp to the city of Winnipeg, 125 miles distant. The Assinniboine scheme has been abandoned. No further information is given.

Power in Light and Power Plant.—The paper by Mr. Milne on "From the Coal Pile to the Meter," which was abstracted in the "Elec. World," Sept. 28, is published in full, with the diagrams, in the "West. Elec.," Oct. 5.

Heating Street Cars.—Prof. Anthony in the "Elec. Jour." (Chicago), Oct. 1, calculates that if two thirds of the heat of the fuel in car stoves is wasted, and assuming the electric heater to be perfect, then three pounds of coal burnt in the car warms it as well as 12 pounds burnt at the central station, and he therefore concludes that electric heaters can never dispel coal stoves on the score of economy, unless a horse-power can be had for less than $5 a year.

TRACTION.

Narrow Gauge Electric Locomotive.—A well-illustrated description of a locomotive which was recently built from St. Mary's Barrack into the submarine establishment at Gillingham, to run on an 18-inch line, is given by Mr. Weekes in the Lond. "Elec. Eng.," Sept. 20. It is to run on a siege railway and one of the objects was that it should work as noiselessly as possible; the motor is so arranged that it can act also as a constant-current transformer to reduce the line voltage of 400 down to 80 for running search lights; the locomotive is in regular use now to transport stores; the total length of the line is about 125 miles, a long section of which has a grade of 1 in 22, the sharpest curve having a 36-foot radius; the arm holding the trolley wire is hinged on the pole and supported by a spring so as to allow of a slight vertical motion, the object of which was to prevent the trolley from jumping when passing the points of support; the speed reduction is 8 to 1, and is effected by worm gearing running in oil coupled to the motor by a flexible strap coupling which can readily be removed when the motor is used for search-light purposes; the complete system of connections of the motor are given, the speed being regulated by using different field windings and resistances; the field has two windings, one a shunt and the other a series, the latter being used for purposes of regulation; the total weight of the locomotive is five tons, and when loaded with four tons more the motor takes 450 amperes, at 350 volts, on the steepest grade, the speed being four to five miles an hour.

Working Expenses of Electric and Cable Railways.—The article mentioned in the Digest last week is concluded in the Lond. "Elec Rev.," Sept. 20. Similar figures are given for the Birmingham and the Edinburgh cable lines; tables are also given showing the comparative expenses and receipts per ton mile of the five different lines; for the half year ending June, 1895, these values in pence were as follows: Liverpool Electric, .38 and .62; London Electric, .43 and .71; Birmingham Electric, 1.87 and 1.43; Birmingham Cable, .71 and 1.55; Edinburgh Cable, .73 and 1.32.

Modern Application of Electricity to Traction Purposes.—A British Association paper by Mr. Dawson is reprinted in the Lond. "Elec. Rev.," Sept. 20, accompanied by a supplement in the form of a large table giving tabulated data of all the electric lines now in operation and under construction in Europe or by European constructors (including those under construction; those built by the European Thomson-Houston Company far outnumber those built by any one other company). The article consists largely of a description of the results obtained in this country. A reprint is begun in the Lond. "Elec. Eng.," Sept. 20.

Bristol Electric Railway.—An illustrated description of this railway is published in the Lond. "Engineering" Sept. 20; it is of interest as it is the first modern electric street railway in England which was constructed after the Board of Trade rules were framed, and if satisfactory, it will serve as types for others in that country; it will shortly be completed; it is constructed by the Thomson & Houston Company.

European Railways.—The first part of a report of a committee sent from Berlin to inspect and report on the various systems used in Europe, is reprinted in the "Elek. Zeit.," Sept. 19.

Accumulator Traction.—In the "Elec. Jour." (Chicago), Oct. 1, Mr. Barnett replies to the recent statement of Prof. Anthony (see Digest, Sept. 14), which he claims contains inaccuracies. Regarding the first cost and rapid deterioration he states that the cost of depreciation of storage batteries is less than that of boilers, engines and dynamos, while the system is more efficient and the service more reliable; if it costs $100 per horse-power to install direct supply machinery in central stations, then storage batteries to handle the maximum load lasting 1.5 hours, cost but $50, so that a plant consisting half of steam power and half of storage battery would have double the capacity of a steam plant and cost only three quarters of what a complete steam power plant would cost for the same work. He claims that the chloride cells are being used with success for train lighting; in his opinion the difference between the cost of the plant for charging batteries and that of a plant to run cars direct, would be very great and would amount to a saving of one third; the important factor is the relation between the average and the maximum load, which on a number of different roads is from 20 to 1,200 per cent. Mr. Crosby gives the relative sizes of a power plant for the direct and storage battery system, as one to two thirds, which he thinks is less than is justified, but it nevertheless shows an economy of 33 per cent. The cost of an underground conduit and that of storage batteries does not approximate unless about eight cars are run to the mile, which is a condition not met with in practice, the average of all

the trolley lines in the country being two cars per mile of track. The complete cost of line equipment with the underground feeders is about $12,000, while the cost of storage batteries for two years would be about $7,500. Thus under average conditions the storage battery would be considerably cheaper. Although the efficiency of the storage-battery system is greater for long lines, he claims that even on short lines the loss of energy is not greater in the trolley system and shows that for the same amount of heat-energy of the coal, 20 per cent. more energy is applied to the axles in the case of a storage battery than in the trolley system, but on long lines it is much more in favor of the battery. He admits that the maintenance cost for batteries is greater than that of a well-constructed line. The total maintenance cost of a power plant rolling stock and battery is about 1.3 cents per car-mile greater than with a direct system, but the smaller interest charges and less cost of power should also be considered and it will then be found to balance.

Accumulator Traction.—The "Elec. Eng.," Oct. 13, publishes some diagrams giving the current and voltage taken on an accumulator car about three years ago; the battery used was the "Acme" belonging to the Planté class and which is to be used on a car to be in operation in a short time on the St. Nicholas Avenue line in New York.

Electric Car Tests.—In the fourth section of the serial by Prof. Hering in "Elec. Ry. Gaz.," Sept. 28, he gives the results of the second test on the Pikesville road, which was made after 68 per cent. of the road had been double-tracked and some of the curves improved; a Thompson recording wattmeter and a Boyer speed recorder were used in addition to the other instruments; the results are given in the form of two large diagrams, and in a third they are superimposed; in another diagram the results of tests made before and after the road was double-tracked are superimposed showing clearly the difference in the character of the performance of the car in the two tests, the difference being quite noticeable; the speed is much more uniform and averaged two miles per hour more; the whole performance of the car is more uniform and although the current was on for a longer time, the total energy for the whole trip was less; the average current in the second test was 33.8 amperes as compared with 38.6 in the first test; for the whole round trip these figures were 29.1 and 31.3; the resistance of the track and the loss on the line were both less.

Electrolysis of Pipes.—In "Cassier's Mag." for October Mr. Brown replies at some length to the method suggested by Mr. Farnham, which was described in the Digest, Aug. 31. He considers that this scheme is of little or no value for that purpose; it would cause a great loss of current (evidently meaning voltage) and would require a serious increase of motive power; the resistance placed near the power-house would move the corroding points farther away and scatter the damage, while the more distant resistances would cause a greater flow to the pipes; it is important to balance the rapidly varying load of an electric line; the rails being in contact with the moist earth that surrounds the pipes, the latter would share the current as long as the rails are used as conductors; the pipes would carry about half the current; his suggestion to protect the pipes by inserting a copper plug connected to the negative terminal would cause local galvanic action. The only practical method of stopping the corrosion of pipes is the one which he (Brown) described (see Digest, March 30), in which a separate dynamo, generating about 12 volts more than the others, is connected between the pipes and the line, making the voltage of the former two or three volts negative to the rails at the points which were previously positive; as long as they are negative, there can be no corrosion; this dynamo represents about one quarter of the total capacity of the station; in one station in Newark about 300 hp are said to have been saved by this; he claims that the station load can thereby be reduced 20 per cent.; it does not check corrosion around a poor joint, but such joints can readily be detected at the surface of the street and the action stopped by connecting them to that dynamo; the action of the system is to increase the current in the pipes, but by proper bonding and feeder regulators in the connections with that dynamo, the current in the pipes can be reduced to a minimum; but even this method is not permanent if the usual electrical connections are made with the pipes. In conclusion he describes the plastic rail bond (see Digest, March 30).

Car Wiring for Four Motors.—The "St. Ry. Jour." for October publishes a diagram of the wiring used on one of the Niagara Falls lines; the object is to secure three economical speeds by the series-parallel method; the two lower speeds are used in the city, and are respectively four motors in series and two parallel groups of two each; when the suburban regions are reached a special switch is turned, which so changes the connections that the first high speed combination is two series groups of two motors in parallel, and the final one of four motors in parallel; in addition there are the usual intermediate positions.

Jungfrau Mountain Railway.—Some further information is given in a note in the "Elec. Ry. Gaz.," Sept. 28. Work on the construction of the first part of the line to the Eiger glacier is to commence in the Spring; this appears to be about half the distance; the speed is to be limited to 5.5 miles per hour on grades of 792 feet per mile or less, and to 4.25 on steeper grades, the steepest being 1 in 4 or 1,320 feet per mile; the gauge is one meter and the sharpest curve has a radius of 327 feet; the tunnel at the Eiger glacier will be 10 feet 6 inches wide and 13 feet high.

Railway System of Niagara Falls.—A long, well-illustrated description of the electric lines running to Niagara Falls is published in the "St. Ry. Jour." for October. An illustrated description of the Buffalo & Niagara Falls Railway is given in the "Elec. Eng.," Oct. 20.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Rotterdam.—A description of the lighting plant in that city by Mr. Brunhes is published in "L'Eclairage Elec.," Sept. 14. The plant is chiefly for lighting and consists essentially of one generating plant of about 300 hp in the outskirts of the city and two sub-station accumulator plants in different parts of the city; the dynamos run night and day and can also be run in parallel with the batteries if necessary; the dynamos generate from 450 to 700 volts, the former being used for direct lighting and the latter for charging the accumulators at the sub-stations. The five-wire system of distribution is used and it appears that the accumulators at the sub-stations are charged from the outside wires only; at the sub-stations there was too little room to put the four equalizers (which consist of 4 motor dynamos on the same shaft, suitably connected with five wires) on the same shaft, and they are therefore locked together by an electric device which consists in connecting three points of the armature 120° apart from each other, to three sliding ring contacts, just as is done when it is desired to generate three-phase currents; the three brushes of these sliding contacts are then placed in connection with the three similar brushes on the second machine, which thus causes them to be locked together as though they were mechanically coupled.

ELECTRO-PHYSICS AND MAGNETISM.

Magnetic Forces in a Point in a Plane.—Referring to the recent paper by Prof. Minchin (see Digest, Sept. 28), Mr. Colard in the Lond. "Elec.," Sept. 20, shows that the result obtained is only a particular case of a more general formula applicable to any kind of polygonal figures; the general formula is that the magnetic force is equal to the sum of the fractions each equal to the sine of the angle divided by that perpendicular. For a plane curve the force is equal to the integral of a fraction whose numerator is the differential expressing the element of the arc, and whose denominator is the product of the radius of curvature, the distance from the point where the force is being calculated, to the element of the arc, and the cosine of the angle between the radius of curvature and that distance.

Propagation of Magnetism in Iron.—In the "Elek. Zeit.," Sept. 19, Mr. Peukert publishes some curves showing the propagation of magnetism in a bar of wrought iron, in one of cast iron and one of iron wires, the magnetism being generated by a coil at its centre, excited by an alternating current; the results are given in sets of curves; no conclusions are drawn.

Electrification and Diselectrification of Air and Other Gases.—An abstract of a British Association paper by Lord Kelvin, Messrs. Maclean and Gault, is published with some illustrations in the Lond. "Elec. Eng." and "Elec. Rev.," Sept. 20. An account is given of experiments made to find approximately the amount of electrification communicated to air by needle points. An abstract with the illustrations appears in "El'ty," New York, Oct. 2.

Action of Condensers in Alternating-Current Circuits.—In the "Elek. Zeit.," Sept. 19, Dr. Benischke gives a comparatively simple, general, mathematical discussion; it differs from that in Bedell and Crehore's book on Alternating Currents.

Theoretical Interpretation of the Experiments of Hertz.—"L'Eclairage "Elec." Sept. 14, contains a mathematical article of Prof. Duhem.

Studies in the Electromagnetic Theory.—The first portion of a paper read by Dr. Pupin at the meeting of the Amer. Assoc. Adv. Sc., is reprinted in the "Amer. Jour. of Sc." for October; in the present portion he discusses the law of electromagnetic flux.

ELECTRO-CHEMISTRY AND BATTERIES.

Storage Batteries.—A British Association paper by Mr. Earle (apparently connected with the company manufacturing the chloride accumulator) is published in full with illustrations in the Lond. "Elec. Rev." and "Elec. Eng.," Sept. 20. After giving a brief history of the secondary batteries, the origin of which he dates back to the experiments of Gautherot in 1801, he states that much has recently been done to perfect and cheapen the production of solid lead plates (apparently meaning plates formed by modified Planté processes) and these he believes are making such strides that it seems probable that they will eventually outstrip and replace their pasted rivals; improved methods have been discovered for affecting rapid formation at a reasonable cost; he believes that in all probability there will be little extension of the use of pasted plates. Aside from the question of cost, he believes the chief points to be considered are chemical action, mechanical construction and proper treatment of the cells when made; he gives the theoretical value of lead peroxide as 4.44 grammes per ampere-hour, or roughly 1 pound per 100 ampere-hours, or assuming that the positive and negative plates were identical, it would be 50 ampere-hours per pound of peroxide and spongy lead; the highest capacity plates yield only about seven amperes per pound of positive and negative plates. The larger part of the paper is devoted to the study of the behavior of cells under various conditions; a number of curves for various relations are given and discussed; one set of curves gives the

capacities per pound of plate for various rates of discharge in hours for seven different kinds of cells (but the names of these are not given); the capacity rises at first rapidly as the time increases, after which the curves become nearly horizontal; another set of curves gives the voltage for different rates of discharge of one type of cell (presumably the "chloride"). He calls attention to the conditions that are frequently given in specifications for storage batteries; in some cases a fall of voltage not exceeding 8, 10 or 12 per cent. is allowed, at a certain rate of discharge, but this, he says, is in most cases unsatisfactory on account of the doubt as to what should be taken as the starting point on which this percentage fall should be based; another set of curves gives the fall of the open-circuit voltage for 21 hours after the completion of the charge, a curve being given for each different strength of acid; these curves fall gradually and the voltages are considerably higher the greater the specific gravity; if the fall of voltage is limited, therefore, it would be advantageous to the manufacturer, but not to the purchaser to allow the battery to stand for a few hours to reduce this first voltage; the best way to meet the point is to take, as the first reading, the voltage five or 10 minutes after the discharge began; specifications generally necessitate a much larger battery than was intended, with corresponding increased cost; the manufacturer may find that the buyer is not satisfied with even a 50 per cent. excess in ampere-hours, but will require to have the volts as well; the most satisfactory way to frame a specification is to specify the exact capacity in ampere-hours and the final voltage of the complete battery at a given rate, the number of cells to do this being left to the manufacturer; a low voltage per cell enables the number of plates per cell to be reduced and the cost as well, and in a competitive tender the manufacturer would therefore work out the cheapest arrangement; the actual number of accumulator cells when discharged down to 1.8 instead of 1.9 is only 2 cells in a 100-volt battery. He shows that no reliance can be placed on the efficiency and capacity determined from a single charge or discharge, as no two consecutive discharges as a rule are identical, each one being influenced by the previous treatment; this is shown by a table giving the first 10 charges and discharges of a new cell which shows the irregular nature of the results obtained with slight variations in time and maximum voltage of charge; if worked within reasonable limits, an efficiency of 90 per cent. in ampere-hours and about 80 per cent. in watt-hours can be obtained when the cell is in good order, but usually the efficiency is of no great importance in central-station work except when the battery supplies the whole demand of the station. He shows the great importance of the strength of the acid, giving the curves showing the great influence on the voltage; it also has a great effect on the life, strong acid sulphates the plates more readily, and they are more difficult to reduce. The resistance of the acid is also important; curves are given showing the specific resistance at different strengths and temperatures; acid of a specific gravity of 1,250 has the least resistance, but this does not give the highest voltage, and it has the disadvantage that during the discharge the gravity diminishes, and therefore the resistance increases while the voltage also falls; different specific gravities also give different capacities, as shown in an interesting curve giving the capacities per pound of active material for different specific gravities at the end of the discharge and corresponding curves for the voltage; they were taken for two chloride cells, one with thin and the other with thick plates, both being discharged at 0.45 amperes per pound of plate; the rate per pound of active material is nearly the same for both, but the rate per area is approximately 40 per cent. greater with the thick plates; the curves for the thin plates show that with acid of 1.070 only about 3 per cent. of the maximum capacity is obtained; the maximum is obtained at 1.230; each 1 per cent. addition in the sulphuric acid gives an increase of about 1 ampere-hour capacity per pound of peroxide; after the maximum point the curve falls about as rapidly as it rose; for the thick plates at 1.040, the capacity is about 6 per cent. of the maximum, which latter is reached at 1.270, after which it falls rapidly; the thin plates give a maximum of 15 ampere-hours per pound of peroxide and spongy lead, or about one third of the theoretical value, while the thick plates give only 10 ampere-hours; he discusses the reasons for this and why the thick plates are best with weak acid, while they are much poorer with the acid usually used; the capacity is practically reduced inversely as the thickness; the voltage curves rise almost steadily with the increase in the strength of the acid; for the same rate of discharge an increase in ampere-hours per pound of material means a longer time to complete the discharge and the greater the length of discharge the higher the mean voltage; he shows the important effect on the life of the cell, of the treatment which it receives after it leaves the manufacturer; purity in the electrolyte is essential; brimstone acid should be used and it should be diluted with pure water, preferably rain or condensed water; fully formed plates are very slightly affected if the first charge does not immediately follow the filling of the cells with acid; another set of curves shows the effects of leaving the plates standing in acid or of charging them; they show how very slight differences can cause considerable variations. The chief causes of destruction are too prolonged or excessive rates of discharge, insufficient charging, overcharging, long periods of rest on open circuit without charging or after complete discharging; a frequent mistake is made in adding acid because the specific gravity has fallen, due to heavy sulphating; instead of adding acid the cells should be given a prolonged charge; the chief thing to be prevented is disintegration. In conclusion he states that considerable study is required, as the results of tests are often conflicting, and depend on very small differences in the conditions.

Hermite Process of Deodorizing Sewage.—A short British Association paper by Mr. Napier, describing the process as applied to the city of Ipswich, is reprinted in the Lond. "Elec. Eng.," Sept. 20; an abstract of the discussion appears in the Lond. "Engineering," Sept. 20. With the process as applied at Ipswich, the sewage is purified while it passes through the main sewer, the deodorizing liquid being introduced at the upper end of the sewer; according to his statement the active bleaching agent is magnesium hypochlorite; the usual working strength is from 5 to 1 grammes per litre; when the sewage is mixed with about 5 per cent. of this solution, the offensive smell is instantaneously destroyed and decomposition is arrested for about six days, which is long enough for the sewage to be well out in the sea; it was found that an 0.8 gramme solution practically sterilized the liquid portion of the sewage when used in sufficient quantities, but solid matter was unaffected; in small quantities it completely deodorizes, and in the large quantities it sterilizes the liquid portions; it has been used in Ipswich for about three months; the strength of the solution varied from half to one gramme and the average quantity of chlorine obtained was 1.04 gramme per ampere-hour; the result of the test was complete deodorization throughout a long length of the sewer. In conclusion he states that he is confident that any town which adopts this process and will erect a plant to produce more than enough of the solution, will be spending money well and in time will feel the benefit by increased health of the inhabitants. In the discussion it appears that the War Office has adopted this system in the Netley Hospital which has a population of 1,500, and where an allowance of six grammes per head has been allowed, while in Ipswich it is only one gramme.

Electro-Chemistry.—A reprint of a course of lectures by Mr. Janet, at the Central Laboratory in Paris, is begun in "L'Eclairage Elec.," Sept. 14; the present portion is elementary.

Future Methods of Sewage Purification.—In an article by Mr. Hedenberg in the "Eng. Mag." for October he discusses the different systems in general and the electric systems in particular with special reference to that of Mr. Woolf, which differs from the well-known Hermite system, in that sewage, garbage, and other matter that has already undergone decomposition is rendered sterile and harmless. He reported briefly on the Hermite system used abroad and states that the principal objection is the introduction of a separate system of pipes for the disinfecting liquids. In the Woolf system it is claimed that ozone is generated besides the hypochlorites. Such a plant was installed at Brewster, N. Y., in 1893; a 15-hp engine was used and it is claimed the plant will suffice for 30,000 people, which will bring the cost down to 17 cts. per year per inhabitant; a bacteriological examination made by the New York Board of Health showed that when the number of bacteria per cb. cm was 33,000, 22,000, 2,353, 4,000 and 7,000 before treatment it was reduced after treatment to 8, 42, 12, 0 and 0 respectively. A comparison of the costs of several different systems is given in cents per inhabitant per year; for the Hermite process at Nice it was 48, for the Woolf system at Danbury 27, for the Chemical and Land process at East Orange, N. J., 71.1, for the Land Filtration plant at S. Framingham, Mass., 83.3, and for the Chemical system at Chautauqua, N. Y., 57.4. He thinks it safe to prophesy that in years to come electricity will play an important part in sanitation. Webster, in England, has taken a step in the right direction by passing the sewage itself through the electrolyzers, adding a salt solution, if there is not enough chlorine in the sewage itself; iron electrodes are used, the iron liberated uniting with oxygen and forming a precipitate which carries down most of the suspended matter.

Electrometallurgy.—A lecture before the Franklin Institute by Mr. Faunce is reprinted in the journal of that institute for October. After an introduction to the subject he describes, more or less fully, the successful processes used in this country in connection with the refining of silver, copper, the reduction of aluminum and of lead. The silver process which is described at some length is that invented by Moebius and used by the Penna. Lead Company, which turns out 40,000 oz. of silver per day. The anodes are made of the unrefined silver enclosed in bags; the electrolyte is a solution of nitrate of silver and nitrate of copper in nitric acid, just enough acid being used to prevent the deposition of copper; the cathodes are thin sheets of pure silver; the bags collect the undissolved metals, chiefly gold, bismuth and lead, with some silver and copper; the pure silver crystals are collected after being scraped off from the cathodes; constant agitation is necessary; a density of 18 amperes per square foot of cathode is used and is an important factor; about 0.2 pound of silver is obtained per hp per hour of a fineness of 999 and often more; of the three metals in the solution, the silver is deposited before the others and will be absolutely pure as long as the copper and lead are not present in too large quantities. He describes the Elkington method for refining of copper, used in 15 to 20 refineries in the United States whose total estimated capacity is 4,000 tons per month; the principle is the same as that of the silver process, the impurities remaining undissolved.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Portable Magnetic Field Tester.—A British Association paper by Prof. Ayrton and Mr. Mather is published, with good illustrations, in the Lond. "Elec." and Lond. "Elec. Eng.," Sept. 20, the latter containing an

additional figure showing in detail the standard exploring coil. The instrument is a modified form of the one described several years ago and is essentially a portable ballistic galvanometer of the moving coil type. The best shape of the cross-section of the moving coil for ballistic galvanometers is not the same as that of a current galvanometer, for while in the latter it should approximate two circles touching one another, for a ballistic instrument it is better to use a sector-shaped coil of a narrow angle (like two narrow V's placed opposite to each other with their points touching). The instrument contains a C-shaped magnet between the poles of which the coil is suspended by a straight phosphor-bronze strip and a spiral surrounding it; the pointer may make one or more complete revolutions, thus giving a long range, with 1.5 to 2 revolutions for instance, the scale is as long as that of an ordinary reflecting galvanometer, about 18 inches; suitable switches cutting a resistance into circuit multiplies the range by 10; the scale reads off directly the strength of the field in C.G.S. units. Sometimes it is convenient to graduate the scale in micro-coulombs and then the swing multiplied by the total resistance of the instrument measures the total change of induction through that circuit; such a scale is useful in testing iron for permeability, in which case the induction density can be read off directly. The theory of the instrument is given. A table is given showing the effects of different-shaped coils, from which it appears that a long narrow coil has a considerable advantage over the common shapes as regards sensibility, admitting at the same time of a much greater range than those forms which necessitate the use of a central core; the swing may also be taken in other direction without reducing the range, while instruments with cores necessarily have their maximum range reduced to less than 90 degrees if arranged to read either right or left. The standard exploring coil which is described and illustrated in the second mentioned journal, consists of a coil fixed to a spindle around which it can be made to rotate 180 degrees by means of a spring in the handle which is released by a trigger which at the same time closes the galvanometer circuit; the area and number of windings of the coil are so calculated that the galvanomer deflections give the induction in C. G. S. units per sq. cm.

Measuring the Internal Resistance of Batteries and Electrolytic Cells.—A paper by Mr. Greef is abstracted briefly, but not very clearly, in the "Elek. Zeit.," Aug. 1, and "L'Eclairage Elec.," Sept. 14. He describes a method of measuring the internal resistance, which consists essentially in measuring the difference of potential while the current is flowing, and calculating the resistance from this, the current and the E. M. F. on open circuit. The poles of the cell are connected to three circuits, the first containing an ampere-meter for measuring the current, the second is for measuring the voltage and the difference of potential when the current is flowing; the third circuit "has a part of its circuit in common with the second circuit," and by means of it the difference of potential at the poles can be compensated (no further description of this is given); this latter circuit contains two accumulators and a resistance box; in addition there was a fourth circuit for measuring the resistance of the cell by means of an alternating current, by the Elsas method, which latter measurement was used as a check. In making a measurement, the circuit containing the ampere-meter is closed, the current measured, the circuit then opened and at the same time the second circuit closed, for measuring the E. M. F. at which the current was generated; this is repeated a number of times until this E. M. F. can be compensated at least for a short time by the third circuit; when thus compensated the second circuit is closed and also the first; "the deflection of the voltmeter is then the difference between this E. M. F. and the difference of potential," from which, together with the value of the current, the internal resistance is readily calculated by the usual formula. All the cells tested showed that with increasing current the internal resistance falls at first rapidly, then slower, approaching asymtotically its final value; if after this the current is diminished, the internal resistance will increase, but the values will be lower than those first obtained; the alternating-current measurements gave in general lower results although relatively to each other they were the same; he suggests that the probable reason for this difference is due to the phase shifting caused by the different capacities and that this may also be the reason why in many measurements of this kind there is no point of minimum sound in the telephone.

Some Experiments Made with Lord Kelvin's Portable Electrometer.—A brief abstract of a British Association paper by Prof. Schuster is published in the Lond. "Elec. Eng.," Sept. 20, and "El'ty," N. Y., Oct. 2. He describes experiments made in Switzerland to test the instrument for measuring atmospheric electricity; no conclusions are drawn except that a mere difference in configuration of the earth is not sufficient to account for the great differences in the electric forces observed.

Standard Coils.—A report of the British Association committee giving the results of tests of the resistance coil at the Cavendish laboratory, is reprinted in the Lond. "Elec. Rev.," Sept. 20, and consists of a table of values of a number of different coils. There is also an appendix regarding magnetic units, which was noticed in The Electrical World last week.

Photometry.—In the second installment of the serial of Prof. Thomas in the "Elec. Jour." (Chicago), Oct. 1 (see Digest, Sept. 7), he gives brief, illustrated descriptions and discussions of the most important standards in use, including the Carcel and Hefner amyl-acetate lamps, the Methven screen and the Harcourt pentane lamp. Among the opinions expressed and the data given the following may be of interest: He considers the Carcel lamp as no better than the sperm candle as a standard, and gives its value as about 9.5 sperm candles; he thinks the German candles show no decided advantage over the sperm candles; although the amyl-acetate was found to be quite constant, readings varying from 0.5 to 1.5 per cent., that impurities are readily detected and avoided, and that the height of the flame is comparatively unimportant, yet the light given out by different lamps made by the same maker has been found to vary to a serious degree, six of them varying over a range of 5.1 per cent., while in another set a difference of 12.1 per cent. was found, which seriously affected the claim that it is an easily reproduced standard; its advantages are its portability, constancy and ease of manipulation, and its disadvantages are its low value, its color and its sensitiveness to air currents; he thinks it is not likely to be adopted as a standard outside of Germany. He does not confirm the claims that by the use of the carburetter the candle-power of the Methven screen is the same with gas ranging between 10 and 20 candles; nevertheless it is quite convenient and gives fairly good results when properly handled, its color being whiter than that of candles; it is more largely used in this country than any other substitute for candles, but it cannot be used as an absolute standard; he thinks it likely that eventually the only safe method to follow will be to use any of these only as a secondary standard and to compare them with a true standard. The Harcourt pentane standard he states is very constant, easily handled, portable, less affected by draughts, and is white in color; he considers it more reliable than any of the other standards; he gives as the value of the Violle standard, 18.5 sperm candles.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Some Lessons in Telephony.—A British Association paper by Mr. Bennett is reprinted in the Lond. "Elec." and in part in the Lond. "Elec. Eng.," Sept. 20. The paper is devoted to a comparison of the extent of telephony in Great Britain with that in other European countries, showing how far Great Britain is behind many of the others, and from this he endeavors to draw conclusions showing the reasons for these conditions; it is chiefly of local interest. Among the figures of general interest may be mentioned the following: the best telephoned town in the world is Mariehamn, the capital of the Aland Islands in the Baltic, in which there is an exchange telephone for every 13 inhabitants; a town in Finland has one to every 33; Norway is the best telephoned country, it having one exchange to each 7,812 inhabitants; a radius of 43.5 miles around Stockholm is unquestionably the best telephoned piece of country in the world, almost every village containing two complete telephone exchanges, and there are rival systems of trunk lines; in Denmark there is an exchange to every 14,639 inhabitants; in Switzerland there is an exchange for every 19,355 inhabitants; in Luxemburg there is one to every 3,577 inhabitants; in Germany there is one telephone to every 449 inhabitants, Great Britain coming next with 636; among the "badly telephoned" countries the best is France with one exchange telephone to every 1,432 persons, and the worst is Russia with one for every 13,102. These are given in a table showing also the leading characteristics of the management; he shows that the telephonic development is proportional to the prevalence of low rates, local management, facilities for rural intercourse, and competition.

Future of the Electric Telegraph.—The "Eng. Mag." for October contains an article by Mr. Delany; it is similar in some respects to other recent articles by the same author; he discusses the effects on communication, of the introduction of a cheap and very rapid system of telegraphy, enabling a large part of the communications now made by mail to be made by telegraph. The Wheatstone system although a great advance over the older method, can never become the telegraph of the future, if the great bulk of the correspondence is to be carried by telegraph, the main obstacle being the limited speed of the electromagnet of the receiver; he believes that this system could not be improved upon to any important degree and its maximum speed falls far short of that necessary for sufficiently low rates to popularize the telegraph. He thinks the system of the future will be one in which the signals are received on chemically prepared paper, thus having no electromagnets or movable parts and no springs or contacts to adjust; the sensitiveness for speed of such a strip of paper is at least twenty times greater than that of any electromagnetic recorder. Recent improvements in perforating machines, transmitters and receiving instruments for automatic chemical telegraphy, he states have brought this ideal plan of rapid communication to such a degree of perfection that it cannot fail to bring about sweeping changes in the transmission of correspondence; 3,000 words per minute can be sent perfectly from New York to Philadelphia, over a copper wire weighing 300 pounds to the mile, or 1,000 between New York and Chicago, over an 850-pound wire; at the latter speed a 50-word message can be perforated in New York, transmitted typewritten and mailed in Chicago at an actual labor cost of three cents, not including the postage stamp; two such wires would carry all the letters now exchanged between New York and Chicago, provided that they did not average more than 50 words; there would be about 40 perforators and typewriters at each end of a single wire. He believes the letter of the future will be dictated to a stenographer, who, instead of typewriting it, will perforate it on the tape, which will then be sent to the telegraph

office, passed through the machine and in a second or two received at the distant end on Morse characters, which will be translated directly on the typewriting machine by the correspondent's stenographer; large commercial houses will do their own perforating and translating, the telegraph for them being a simple carrier, having nothing to do with the correspondence, nor will the messages be read by the company's employees. In conclusion he advocates government control of the telegraph, stating that to-day the United States is the only country that does not control its telegraphs; an editorial presenting the other side of this question is added to the article.

MISCELLANEOUS.

British Association Meeting at Ipswich.—A running account of the meeting, including brief references to the papers and discussions, is begun in the Lond. "Elec.," Sept. 20. The address of Prof. Hicks on ether structure called for appreciative remarks from Lord Kelvin who stated that he looked forward to the time when electrical, chemical, gravitational and every physical action could be explained by some hypothesis of a universal medium or ether. In a paper by Mr. Douglas Galton, on the German Reichsanstalt he recommended that the British government create a similar institution; it was the general consensus of opinion as expressed in the discussion, that in the matter of pure research Great Britain was far behind Germany. A long abstract of Prof. Vernon-Harcourt's address is published in the Lond. "Elec.," Sept. 20. He refers to the relation of engineering in general, and maritime and hydraulic in partiular, to pure science. Sir Douglas Galton's address is given in abstract in the Lond. "Elec.," Sept. 20. Prof. Hicks's presidential address is published in abstract in the Lond. "Elec.," Sept. 20, and is commented on favorably in an editorial in the Lond. "Elec. Rev.," Sept 20; the principal subject of the address was the vortex atom theory of matter and the vortex sponge theory of the ether. Lond. "Engineering," Sept. 20, publishes a long running account, including abstracts of the papers and the discussions. A number of the electrical papers are abstracted under their respective headings in the Digest this week; references to some of them were given last week.

Fires of Electrical Origin.—A paper by Mr. Merrill read before the Fire Underwriters' Association of the Northwest, is reprinted in full in the "West. Elec.," Oct. 5, and "Elec. Jour." (Chicago), Oct. 1. Through the co-operation of the inspectors of the United States, records are now being kept of electrical fires, and thus far there are accounts of nearly 1,000 such fires although the records are not complete; after the first year during which the reports were collected the loss amounted to 1 to 1.5 million dollars. Out of 815 electrical fires, 113, or over one seventh, were caused by the crossing of telephone, telegraph and similar wires with trolley or electric light wires; the total loss due to these was about one third of a million dollars; as a remedy he urges the removal of conducting wires from exposure to the elements, as the only absolute cure; he urges the burying of wires in cities and the providing of proper guard wires in the country districts. The second important cause of fire is the use of wood for bases of cut-outs, switches, hanger boards, etc.; this was responsible for 67, or one twelfth of these fires. He recommends teaching the laws of electricity in the common schools in order that the people may know, in a general way, how to handle electric lights and such apparatus.

Biographical.—The "Elec. Jour.," (Chicago), Oct. 1, publishes a full-page portrait of Sir Humphrey Davy.

New Book.

ENGINEERING CONTRACTS AND SPECIFICATIONS. Including a brief synopsis of the law of contracts and illustrative examples of the general technical clauses of various kinds of engineering specifications. Designed for the use of students, engineers and contractors. By J. B. Johnson, C. E. New York: Engineering News Publishing Company. 417 pages. Price, $4.

Prof. Johnson's "Engineering Contracts and Specifications" falls into the category of valuable and, after a short acquaintance, indispensable engineer's reference books; plainly and tersely written, excellently arranged, conservative in statement and, for the most part, treating the subject-matter thoroughly. It is unique in that, while appealing more directly to the engineer and the student, it is, nevertheless, almost as necessary to the contractor and the purchaser.

Part I. is devoted to a comprehensive synopsis of the law of contracts. Part II. treats in considerable detail general clauses in engineering specifications and accompanying documents; the reason for the existence and use of each clause is clearly set forth and followed by an illustrative example.

For a large number of readers these two sections are the essential part of the book and would make a valuable and very convenient hand-book if published as a separate volume.

Parts III. and IV. consider specific, descriptive and technical clauses in specifications, and give illustrative examples of complete contracts and specifications, both parts being almost entirely devoted to actual specifications covering a wide range of subjects. The examples "are not given to be blindly copied, but rather as illustrating a good method of treating the subject and to serve as patterns as to manner as well as matter," and as such serve their purpose admirably.

The book abounds in valuable suggestions and sound advice, and errs, unlike most books, rather on the side of being too brief, due, probably, to Prof. Johnson's opinion that "the writing of engineering specifications is wisely left for engineers of large experience." We cannot unreservedly concur in this view and believe that examples illustrating the errors into which inexperienced and incompetent engineers fall would add to the value of the book for students and young engineers, for whom it was originally designed. The fault with most specifications lies not so much in what is omitted as in what ought to be omitted.

The relations of the engineer to the purchaser and to the contractor often give rise to complications of a more or less serious character, especially trying and perplexing to the young engineer; these relations are dismissed with the statement that the engineer "occupies a judicial and not a partisan position and he is expected to act justly and fairly toward both parties."

Articles 86 and 88 to 91, inclusive, on the subject of damages on account of failure to complete work, suspension of work, delays, unforeseen difficulties and finished work, deserve further elucidation. There are two sides to the damage question, but engineers too often ignore the contractor's side in stringent damage clauses, relieving the purchaser of all claims whatsoever or in extreme penalty clauses; not only are there certain risks which the purchaser ought to assume, but too stringent clauses unquestionably tend to bar the better class of contractors since they will not assume the risks imposed without added compensation, while the irresponsible contractor will take his chances, having everything to gain and little to lose.

The important subject of tests is not touched upon except as regards specific methods; this is to be regretted, for there seems to be a mania more especially among young engineers for specifying tests and guarantees which contractors know to be impossible of verification. It would be difficult to devise a better method for insuring the use of inferior appliances and material since irresponsible contractors do not hesitate to guarantee better results than honest contractors at the same or a less price, and to use inferior material knowing their guarantees cannot be disproved.

Inspection and supervision are barely touched upon, though there is nothing in connection with contract work more unsatisfactory, more profitless, more unproductive of results in comparison with their cost than present methods of inspection and supervision; there is no question as to the soundness of their fundamental principle, but in practice their achievements have been simply infantile in proportion to their theoretical importance.

In general carefully and thoughtfully written, the statement, in speaking of the preparation of specifications, "it is wise to assume that the contractor will be a more or less irresponsible party, without reputation to sustain, and whose sole object is personal gain" challenges attention; we believe not only that the opposite condition may be assumed, but that a specification is weakened and debased by such assumption; no amount of restrictions, threats, penalties or supervision can compel an irresponsible and dishonest contractor to do good work, and to draw up a specification on the assumption that the contractor will be a "more or less irresponsible party" is to assume that workmanship is dependent on the wording of the specifications rather than on the character and ability of the contractor, and puts irresponsible bidders on an equality with responsible bidders, thus virtually playing into the hands of the former.

Such omissions, however, and they are very few, are easily condoned in the pleasure and profit one derives from Prof. Johnson's thorough treatment of an important subject hitherto much neglected, and about which there has been little information in an available and logical form.

A New Primary Cell.

The Gordon primary battery cell, shown in the cut below, and which is manufactured by the Gordon-Burnham Battery Company, 82 West Broadway, New York, is claimed by the makers to possess a number of superior points, among which are the following:

GORDON BATTERY.

It is warranted to operate six months without any attention, at a discharge rate of eight to ten one-hundredths of an ampere; to work equally well on closed or open circuits; to be absolutely non-freezing and free from local action when not in use; and to yield four times as much energy, for a given weight, as can be obtained from a Callaud (bluestone) cell.

The life of one charge of the cell is six months, during which period the battery requires no attention, and recharging is the work of but a few moments. A comparison between 16 Gordon cells and 50 gravity cells, made by Mr. W. M. Kinch, assistant superintendent of signals for the New York Central Railway Company, resulted as follows:

With the gravity cells coupled 16 in series, delivering .017 ampere, the voltage at the beginning was 12.2; the 16 Gordon cells under similar con-

ditions gave an E. M. F. of 13 volts. At the expiration of 23 days the gravity cells showed an E. M. F. of 10.6 volts, while the Gordon cells tested up 11.8 volts. At another time the gravity cells were connected with idle resistance and the current run up to $\frac{1}{10}$ ampere; the E. M. F. dropped to 6.6 volts. The Gordon cells were then tried and furnished .18 ampere of current, at an E. M. F. of 11.4 volts. When the two sets were disconnected, the gravity batteries recovered somewhat, the voltage going up to $8\frac{1}{2}$; the Gordon cells, however, showed the original E. M. F. of 13 volts as soon as the load was removed. Mr. Kinch also tested the anti-freezing qualities of the battery last Winter by placing a cell out of doors when the temperature was about eight degrees below zero. He reports that there was no tendency whatever to yield to the cold.

Severe Car Motor Service.

The accompanying engraving, taken from a photograph, serves to show under what excessive disadvantages electric car motors can successfully perform the work expected of them. The photograph was taken on one of the streets of Middletown, Conn., last Spring when the pavements were covered with water to a depth of a foot or more. The piece of track shown in the illustration is a part of the main line of the system, and for two days all the cars of the Middletown Street Railway Company, Supt. Goss states, made their regular time through this water,

A Nautical Electric Service.

some of them hauling trailers, without the loss of a fuse or any damage to the motors. The motors are G. E.-800 machines, worked in connection with "K 2" controllers.

Long-Distance Transmission at Portland, Ore.

The work of utilizing the great water powers of the far West is progressing rapidly. Within the past month two electrical plants for the transmission of power from waterfalls over long distances have been installed, one at Sacramento, Cal., and one at Portland, Ore. The latter plant was installed by the Portland General Electric Company, of which Mr. P. F. Morey is president. The company owns the water-power of the falls on the Willamette River at Oregon City, 12 miles above Portland, which with a head of 40 feet, has a capacity estimated at 50,000 hp. Part of the power has already been utilized by numerous factories and mills erected near by, and in addition to these an electric station erected some years ago has supplied current for lighting the streets and dwellings of Portland and for operating an electric street railway between Oregon and Milwaukee, seven miles away, the direct-current and high-frequency alternating systems being used.

The station is located on the west side of the Willamette River, opposite the city of Oregon, and is being put up in sections. Twenty sections will complete the building; five are already built, and foundations are now being laid for the remainder. The ultimate generating capacity of the station will be 12,800 hp. The station building is of concrete, stone, iron and brick, and when finished will have a length parallel with the river of 364 feet. The water is taken from the canal on one side, led through an extensive hydraulic installation and discharged into the river below on the other side. The water-wheel plant consists at the present time of three units, each consisting of a pair of vertical cylinder gate improved Victor turbines, one wheel being 42 inches and the other 60 inches in diameter. The larger wheel is brought into service only at periods of excessive high water, which the records show occur about once in every five years. The smaller wheel runs at a speed of 200 revolutions per minute, and the larger at 100 revolutions per minute; both turbines are set at the same level, and the shaft of the larger wheel carries a pulley. The upper end of the 42-inch wheel shaft is provided with a coupling for connecting it with the shaft of the dynamo, which is mounted above it, as shown in Fig. 1. The generator shaft carries a pulley in line with that on the shaft of the larger turbine, so that the smaller turbine may be uncoupled and the generator belted to the larger of the two wheels. When the smaller turbine is operated alone the belt lies upon a shelf surrounding the pulleys.

The weight of the vertical shaft with the armature is about 33,500 pounds, and to carry this a system of extra bearings is introduced, one of the ring-thrust type and the other a hydraulic oil bearing, both supplementing the ring bearings on the armature shaft. They are enclosed in cases filled with oil delivered by hydraulic pressure, and are surrounded by water jackets. The length of the generator shaft is 29 feet, and it is $8\frac{3}{8}$ inches in diameter.

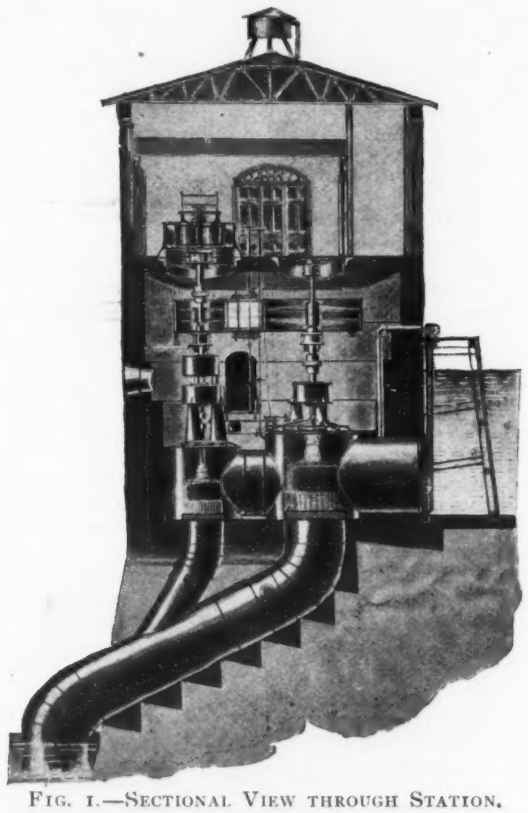


Fig. 1.—Sectional View through Station.

Both wheels in each section are controlled by hand wheels and both are regulated by the same governor. The belt tightener is also controlled from either floor by a hand wheel. Water is admitted to the penstocks from the upper canal by means of a head gate operated from a platform on the canal side of the station. Each penstock is ten feet in diameter and is constructed of riveted steel plates. Each wheel has its own flume, the water passing first through the large flume of the larger wheel to the flume of the smaller wheel whence it passes through a tube into the tail race. In addition to these turbines there is an additional equipment consisting of a set of pumps, including a hydraulic pump for supplying oil to the thrust-bearing cylinders and a duplex water pump to circulate the water in the cylinder water jackets. They are operated by two 15-inch horizontal turbines enclosed in the same flume.

For the operation of the exciters another pair of vertical turbine wheels has been installed, each 48 inches in diameter, driving the generators by a similar system to that already described for the operation of the large machines. The complete power plant will consist of 20 three-phase generators, with two direct-current machines acting as exciters.

The five sections of the building already erected are occupied as follows: The first section contains the pumps and the accumulators for the complete station; in each of the three next sections is one three-phase generator of 450 kw capacity, and the fifth section contains two 250-kw multipolar continuous-current generators used as exciters. One exciter is capable of supplying the fields of all of the 20 three-phase generators, the second machine being set up as a reserve in case of accident to the first. At present one of them is furnishing current to the street railways in

Oregon City. When the station is complete the exciters will be removed from the fifth section and placed in the centre section of the building, where the switchboards will also be erected.

The generators are of special design and are set upon the floor of the station, the armature revolving in a horizontal plane, with one bearing at the floor line and another on top of the armature underneath the collector rings. Each generator has 20 laminated poles. The armatures are a little over seven feet in diameter and are about two feet high. They are constructed to deliver current to the line at 6,000 volts E. M. F. without the intermediation of step-up transformers. On account of this high voltage unusual precautions were necessary to perfect the insulation

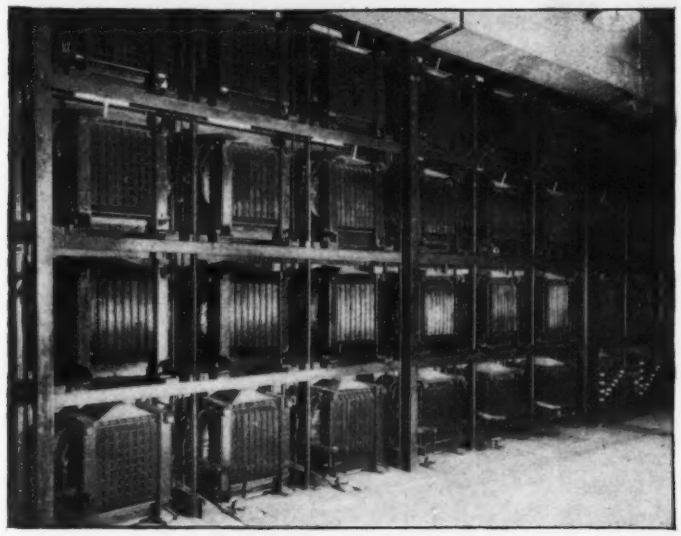


FIG. 2.—TRANSFORMER BANK.

of the armature coils in order to avoid leakage to the ground. The armatures are wound with flat wire and each of the coils is divided into sections, each section being separately insulated. The armatures were subjected to a pressure of 15,000 volts alternating current, and were both short-circuited and open-circuited under full excitation, it is stated, without the slightest injury.

From the dynamos the leads are run to floor connectors and pass underneath the floor to the switchboard. The concrete floor is laid over them and thorough protection provided. The exciters are also of the vertical type, so that the armatures revolve in a horizontal plane; there is one bearing only, at the floor line. The construction of these exciters is almost identical with the General Electric multipolar type of railway generator, and each has a capacity of 250 kw at 125 revolutions per minute.

The line is 14.3 miles long, a separate circuit being provided for each machine. It passes through an undulating country following the course of the Willamette River as closely as possible. The poles upon which the three-phase wires are strung also carry a number of wires for the 5,000-volt continuous arc current from the old transmission station, as well as the wires over which the old system of lighting with high frequency 5,000-volt alternating-current is effected. The loss in the long-distance transmission line is calculated at full load at about 11 per cent.

The sub-station to which the high-tension lines are brought is a two-story building, covering a space of 40 feet by 100 feet. The lower floor is divided into three rooms, one containing the transformers and the second the rotary converters, the other being used for a repair shop, lamp and meter room. The upper story of the building is occupied by the offices.

In the transformer room at present are 45 transformers, the receiving end of each line being connected to a bank of 15 transformers, five of which are placed between each pair of wires of the three-phase system. The transformers are mounted on an iron rack five transformers high and three wide, as shown in Fig. 2. Each set of five transformers is connected to the primaries in series and to the secondaries in parallel. The transformers are said to regulate at a little over 1 per cent. variation of the secondaries from no load to full load. The transformers are of the standard General Electric sub-station type, having numerous air passages between successive bunches of iron laminæ and between the coils so that they may be cooled by artificial ventilation. The distribution of light from the secondaries is effected on the four-wire system, which allows the working of synchronous and induction motors from the lighting mains. The four-wire system is worked at 1,000 volts between wires and by means of feeder regulators a variation of 4 per cent. in either direction is covered.

The direct current for the railway service is obtained by means of rotary transformers. Two of these are at present installed in the sub-station, and space has been left for three more. Each converter will deliver 500 hp to the bus bars of the continuous-current switchboard.

The long-distance transmission lines for this railway service, as in the case of the lighing circuits, are connected to step-down transformers, transforming the current from 6,000 volts on the line to 400 volts at the secondaries, which feed the rotary converters; the rotary converters are compound for self-regulation, and run at 500 revolutions a minute.

At present the lighting from the three-phase system is used for large buildings, containing several hundred lights each. They are close to the city station, and this distribution can be readily handled at about 400 volts. For the outlying and residential districts the high-frequency apparatus with individual transformers will still be employed. Continuous current will be furnished to the stationary motors already installed, but new motor installations will be made with the three-phase motors, which will be run straight from the three-phase switchboard, in parallel with the rotary transformer.

The railway current will be carried to the East Side Railway station by means of cables under the Willamette River, and this distribution will reach as far Milwaukee, where connection will be made in parallel with the 600-volt service from either Station A or Station B at Oregon City. The loop from Oregon City to Portland and back will thus be as follows: Beginning at Oregon City with 33-cycle three-phase current at 6,000 volts 14.3 miles will be traversed as far as Portland; the current will then be transformed to 400 volts alternating and passing through a rotary converter, issue therefrom at 600 volts continuous, which will be transmitted eight miles to Milwaukee and connect with the continuous current from Oregon City.

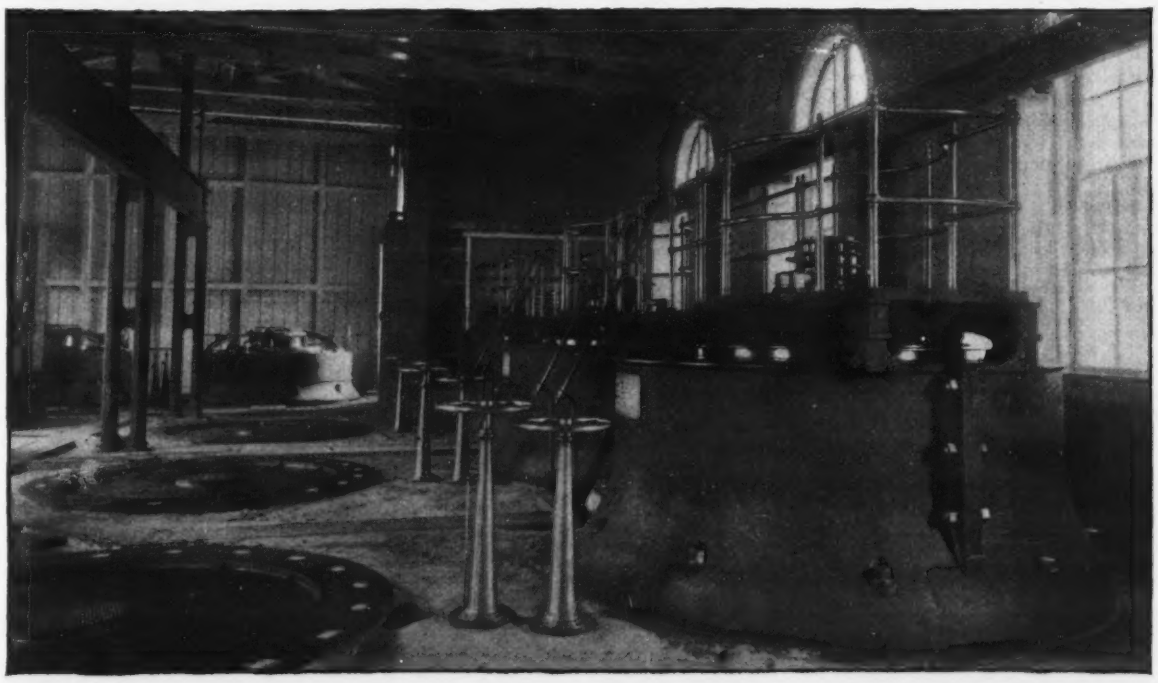


FIG. 3.—INTERIOR OF STATION.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Oct. 5, 1895.

ELECTRICAL STOCKS this week suffered something of a relapse into their former lethargic state. American Bell and General Electric displayed a little activity, advancing a few points from Monday's opening. The balance of the list, excepting Electric Storage and North Shore Traction, was practically inactive. The General Electric people have obtained good legal advice to the effect that the General Electric preferred stock cannot be scaled. It is believed in well-informed quarters that when the General Electric is ready to resume dividends the common stock will be scaled by making its par $50 or issuing one share of the par of $100 for each two shares now outstanding, and that the back dividends will previously be paid on the preferred stock; $14 per share had accumulated up to last July.

ELECTRIC STORAGE BATTERY stocks continued uninterruptedly in their upward course this week, and at to-day's close were quoted at figures 50 per cent. better than those at which sales were made three weeks ago.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Chicago Edison Company	100	120	125
Edison Electric Ill., New York	100	99	101
" " " Brooklyn	100	110	115
" " " Boston	100	..	152
" " " Philadelphia	100	..	115
Edison Ore Milling	100	13	15
Electric Storage Co., Philadelphia	100	65	65¾
Electric Storage, pref	100	68	69
General Electric	100	38⅝	38⅞
General Electric, pref	100	69	70
Westinghouse Consolidated, com	50	35¾	36
" " pref	50	55	..
BONDS.			
Edison Electric Ill., New York	105	105½	105½
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	..	90¼
TELEGRAPH AND TELEPHONE.			
American Bell Telephone	100	200	..
American District Telegraph	100	35	40
American Telegraph & Cable	100	93	96
Central & South American Telegraph	100	117	120
Commercial Cables	100	150	..
†Erie Telephone	100	..	62½
Gold & Stock Telegraph	100	105	..
New England Telephone	100	90	90¼
New York & New Jersey Telephone	100	103	105
Postal Telegraph-Cable	100	63½	..
Western Union Telegraph	100	92	92⅝
ELECTRIC TRACTION STOCKS.			
Baltimore Traction	25	18½	19
Binghamton RR. com	100	100	..
Brooklyn Traction	100	13	15
" " pref	100	60	63
Buffalo St. Ry	100	84	86
Cleveland City Ry	100	69	70
Cleveland Electric Ry	100	59	60
Columbus St. Ry	100	54	56
Consolidated Traction of N. J	..	25	..
Electric Traction, Philadelphia	50	74¾	75¼
Hestonville	100	..	56
Long Island Traction, all pd	100	19½	20
Louisville St. Ry. com	100	37	39
" " " pref	100	87	88
New Orleans Traction	100	20	23
" " pref	100	70	73
North Shore Traction	100	38½	40½
" " pref	100	89	91
People's Traction $30 pd	25	68	68¼
Philadelphia Traction	50	84⅞	85¼
Rochester St. Ry	..	39	40
Union Ry. (Huckleberry)	100	112	115
West End, Boston	100	72	72¼
" " pref	100	93	94
Worcester Traction	100	17	18
" " pref	100	88	91
BONDS.			
Buffalo St. Ry. 1st con. 5s	100	108	110
*Binghamton Railway Co. 5s	100	99	100
*Columbus St. Ry. 1st 5s	100	100	102
Rochester St. Ry. 1st 5s	100	101½	103½
*Union Ry. 1st mtge 6s	100	105	108
*Westchester Electric 1st mtge 5s	100	98	101

* With accrued interest.
† Ex-Div.

THE TRACTIONS.—The Traction market shows more signs of strength than for some time past and the rapid advance in North Shore securities has been the feature of the week. The common stock opened dull at around 35 and the preferred about 86. The publication of the August report, however, and the announcement of the fact that the securities of the company have been listed on the Boston Stock Exchange, caused both the common and preferred to rise rapidly to-day, and sales are reported as high as 38¾ for the former and 89½ for the latter. The gross earnings for the month of August were $177,493, a gain of $26,469, and the net $104,429, an increase of $26,843, while the road was operated at 45⅛ per cent. against 48¾ per cent. last year. The gross earnings of the past eight months have increased $68,857, and the net $35,461. The gross earnings of the Lynn & Boston Railway (controlled by the North Shore Traction Company) for the month of September were $130,674, an increase of $16,942 over the same month a year ago. Predictions of much higher prices for North Shore securities are prevalent on the street. Columbus Street Railway (Ohio) stock continues somewhat stronger. The gross earnings of the company for the fourth week of September show again of $1,382. Buffalo Railway stock has been very inactive during the week, but sales of the "Consols" are reported as high as 109 and interest. Worcester Traction Company's August report shows a gain of $8,613 in gross and $6,883 in net. In consequence of the continued increase in earnings the preferred stock has sold as high as 89¼, and it closes strong and in good demand. Rochester Railway, in common with the rest of the list, has advanced fractionally. The August report shows that the gross earnings have increased $20,552 and the net $10,413.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, Oct. 7, 1895.

ATTACHMENT OBTAINED.—The Complete Electric Construction Company last week obtained an attachment in the Supreme Court for $10,451.43 against the Rockaway Electric Light Company, on notes and for money advanced.

MR. CUTHBERT McCALLUM, of Johannesburg, South Africa, is at present in New York and will visit Chicago and other important American and Canadian cities before returning home. Mr. McCallum is interested in electrical matters in general and district messenger service apparatus in particular. He wants to know who makes the best district call box. Mr. McCallum's address while in New York is 62 Liberty Street.

THE BRYAN-MARSH COMPANY, of 136 Liberty Street, is having quite a run on low voltage lamps, for use in conjunction with storage batteries. The factory is overrun with orders of all kinds, and is working overtime to keep up. Something of a curiosity is being produced by this company in the shape of a high candle-power lamp for surgical use. The lamp is surrounded by an outer glass globe and water is circulated between to carry away the heat and prevent discomfort to the patient.

THE ELECTRICAL WORKERS and Theatrical Employees' unions have been at odds about the electrical work in the theatres. The former complained that members of the latter were doing work in Hammerstein's Olympia, and the matter was referred to the arbitration committee of the board of delegates, who decided that all work behind the scenes should be done by the members of the theatrical union, and all electrical work on theatres in course of construction shall be done by the electrical workers.

THE FALL SEASON opens very brightly for the Boudreaux Dynamo Brush Company, of 253 Broadway. All the company's agents report very brisk business and there are few towns in the United States which have not been supplied with some of the new foliated anti-friction metal brushes manufactured by the company. Mr. Hugo Benedict, general manager of the company, feels very happy to see his efforts rewarded after a year's work up hill by finding that the Boudreaux dynamo brush has become a decided favorite among electricians.

MR. E. W. LITTLE, general manager of the Interior Conduit & Insulation Company, will be present at the coming convention of the American Street Railway Association at Montreal, where he will treat the delegates to a complete and comprehensive exhibit of the Interior Company's new underground feeder system for street railway service. The well-earned reputation enjoyed by Mr. Little and his company for progressiveness and thoroughness in whatever they undertake is a guarantee that the promised exhibit will be not only interesting but instructive.

H E. COLLINS & CO., of Pittsburg, Pa., sole sales agents for the Cahall vertical water tube boiler, manufactured by the Aultman & Taylor Machinery Company, of Mansfield, O., have opened a branch office in the Havemeyer Building, in charge of Wm. R. Sattler & Co. Mr. Sattler is an engineer of wide reputation, and was for some time at the Brooklyn Navy Yard, and Mr. Geo. C. Tewksbury, the other member of the firm, is well and favorably known throughout the New England and Eastern territory as a very successful salesman in the line of engines, boilers and general mill machinery. Messrs. Collins & Co. are fortunate in having secured the services of two such able men.

I. P. FRINK, of 551 Pearl Street, manufacturer of the well-known Frink reflectors, has recently equipped the following prominent buildings: Evangelical Lutheran Church, Cumberland, Md.; Baptist Church, Amherst, N. S.; St. Paul's School, Lagos, West Africa; Lutheran Church, Van Wert, O.; Drill Hall, 14th Regiment Armory, Brooklyn; Evangelical Church, Wilkes Barre, Pa.; Central Presbyterian Church, Akron, O.; Opera House, Portland, Ind. Frink reflectors have long been standard articles with the electrical fraternity, and the flourishing condition of Mr. Frink's business demonstrates the soundness of his views of years ago, when he took the decided stand that the best was none too good.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, MASS., Oct. 5, 1895.

THE BILLINGS & SPENCER COMPANY, Hartford, Conn., has accepted the selling agency of the Kelsey Electric Railway Specialty Company's manufactures, which, in connection with the excellent railway material of its own manufacture, covers a strong list of desirable specialties incident to railway equipment.

MR. J. BRODIE SMITH, superintendent and electrician for the Manchester (N. H.) Electric Light Company, and also identified with other electrical interests in Manchester, made a pleasant call at this office this week, on his way home from a two weeks' vacation. Mr. Smith is one of the exceedingly bright and active men in the electrical field, and is so very busy always that a vacation is something new to him.

CLEAN YOUR BELTS.—Managers of electric lighting and power plants using belting will be interested in the announcement that the firm of Newell & Knowlton, of Peabody, Mass., prominent manufacturers of greases and dealers in scrap leather, make a specialty of extracting greases from leather belts. If belts slip because of being saturated with oil or grease this firm guarantees to extract the deleterious substance without injury to the belt and make the latter run as good as when new.

THE MASSACHUSETTS CHARITABLE MECHANICS' ASSOCIATION opened its triennial exhibition to the public on Wednesday morning, Oct. 2, and will continue until Nov. 30. As this exhibition also marks the centennial of this organization the opening exercises were of exceptional interest and in which representatives of the state, city, general government and educational interests generally participated. The exhibits of manufacturers, industries, and mechanics are varied, in which, of course, electricity conspicuously figures.

MR. C. B. PEAR, of the firm of A. & J. M. Anderson, Boston, has only recently returned from a brief vacation in Europe. The trip was solely for pleasure and recuperation and did not include business at all other than a visit to the London agency of this firm. Mr. Pear is one of the creditable representatives of the younger element in the electrical field, the management and detail of the large and continually increasing business of the Messrs. Anderson having always devolved upon him, and in the discharge of these duties he has always exhibited most admirable sagacity. He enjoys the complete confidence of his firm and had made hosts of friends in the electrical field, all of whom will be pleased to know that he returns from his well-earned vacation looking well and happy.

THE ELECTRIC STORAGE BATTERY COMPANY, through its local office, recently contracted with the Lawrence (Mass.) Gas Company for 140 of its new type elements known as "Type R" chloride accumulators. With this type of battery a two-hour discharge is claimed to be possible—a terrific rate and an entirely new departure, as all batteries are built for 10-hour discharge. This battery will discharge at the rate of 200 amperes, and will take the peak of the load during the busy hours of the evening. The Electric Storage Battery Company is entitled to congratulations upon being able to build such a battery and to guarantee that its depreciation shall not exceed 5 per cent. per annum. The Electric Storage Battery Company is doing an excellent business through its New England office under the efficient management of Mr. Arthur E. Childs, aided by Messrs. Alfred Clark, J. Y. Bradbury and F. J. Stone. A contract has recently been closed with the Boston Electric Light Company for a fair-sized battery for testing work in its laboratory.

THE GRAHAM EQUIPMENT COMPANY has just received several important orders from the South for its well-known truck and other railway manufactures, and reports business all round as exceedingly good. Mr. J. H. Graham, its manager, is always pushing ahead. Idle moments are entirely foreign to his makeup. If he is not hustling personally after business, he is superintending the circulation of his excellent literature descriptive of his valuable electric railway specialties. He is a thorough believer in judicious advertising. "Electric Railways and Other Ways" is the title of one of his most recent leaflets, introducing in nutshell form the important features of the Graham truck, including Graham's equalized brakes, and illustrations of Graham's spring-suspended steel-frame car and steel push snow-plow, with descriptive matter. Mr. Graham reports that the steel-frame cars are giving most excellent satisfaction at Tampa, Fla., and that inquiries regarding them are increasing every day. One of these cars will be on exhibition at the Montreal convention.

WESTERN NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., Oct. 4, 1895.

THE HEINE BOILER COMPANY is very busy, and feels the long-predicted improvement in business.

THE WAGNER ELECTRIC COMPANY, of St. Louis, is now running full time, in order to keep up with its orders.

THE KOCK HILL ELECTRIC COMPANY, of St. Louis, is putting on the market a useful automatic fire alarm, which can be placed in any part of a building.

THE INTERNATIONAL ELECTRIC COMPANY, of St. Louis, is equipping a very handsome factory, and will soon be in a position to turn out high-grade incandescent lamps under the supervision of Mr. Davey.

THE D. A. KUSEL TELEPHONE MANUFACTURING COMPANY, of St. Louis, has closed four large contracts for entire systems, and just completed a system at Gallatin, Mo., that is said to be giving great satisfaction.

THE SCHULTZ BELTING COMPANY, of St. Louis, has just shipped to Moscow, Russia, 18,000 feet of belting, including a belt 70 feet long and 23 inches wide, and is now making for a Boston customer a double belt 242 feet long and 24 inches in width.

THE AMERICAN ELECTRIC MANUFACTURING COMPANY, of St. Louis, reports a decided improvement in the business outlook for this Fall. Mr. Louis Nahm says that under their new superintendent, Mr. A. L. Reinmann, they are putting out unsurpassed high-grade lamps.

MR. H. B. VANZWOLL, for several years connected with the wholesale hardware firm of Hibbard, Spencer, Bartlett & Co., has taken an interest in the Sunbeam Incandescent Lamp Company, and has been elected secretary, Mr. F. S. Terry, who formerly held that office, being made vice-president.

THE JENNEY ELECTRIC MOTOR COMPANY, of Indianapolis, has under construction a very large and elegant shop, which, when completed, will give the company ample facilities for the prompt handling of its flourishing business. At present something of a handicap exists, and the factory is running night and day to keep up with orders.

THE COLUMBIA LAMP COMPANY, of St. Louis, has recently installed two 100-hp boilers with Hawley down-draught furnaces, and one 175-hp Ideal engine; a large number of mercury pumps have been added to the factory equipment, in order to keep pace with the business, which has increased to such an extent that for the last six weeks the company's orders have exceeded its output.

ROSS, WILSON & COMPANY is the name of a new engineering firm, with headquarters at 418 The Rookery. W. A. Ross, the senior partner, has long and ably represented the Campbell & Zell interests in the West, and Charlie Wilson, one of the most companionable of men, formerly represented the Ohio Filter Company, but during the past eight years has been the northwestern representative of the Babcock & Wilcox Company, with headquarters at Minneapolis. The C. & Z. water-tube boilers and the Standard scales are the specialties handled by this enterprising firm.

ENGLISH NOTES.

[FROM OUR OWN CORRESPONDENT.]

LONDON, Sept. 25, 1895.

DEATH OF HERR SCHUCKERT.—The death, at Nuremberg, is announced of Herr Sigmund Schuckert, of dynamo fame. The deceased was still in the prime of life, being only in his 49th year.

ENGLISH TELEGRAPHIC STATISTICS.—In a report just published by the postmaster general for the year ending March 31, last, it is stated that some 71½ million telegrams of all kinds were forwarded in the United Kingdom during the 12 months covered by the report, an increase of only .97 per cent. upon the total for the preceding year. Ordinary inland telegrams show an increase, however, of 1.26 per cent., and foreign telegrams of no less than 4.5 per cent.; press messages, on the other hand, exhibit a decrease of 3.2 per cent. The average value of an inland telegram is 7.66 d., as compared with 7.64d. for the previous year. The use of cycles for facilitating the expeditious delivery of telegrams is being tried.

ELECTRIC SUPPLY AT 220 VOLTS.—A considerable flutter was recently created in the dovecotes tenanted by consulting electric wiring engineers and suppliers of electric-light fittings, by a peremptory circular, issued by the electricity department of the St. Pancras Vestry. This circular, dated Sept. 10, stated that on and after Sept. 1 "the supply to consumers' premises will be delivered at 220 volts." So far as the Board of Trade is concerned, this drastic measure may be meted out to all *new* customers of a three-wire system, since anything up to 300 volts pressure is allowed inside a house, and so long as a company or vestry keeps to the pressure they declare at a consumer's terminal on connecting up, all is well. The circular, however, was naturally taken to mean that a 220-volt supply, necessitating 220-volt fittings and lamps, would immediately be sprung on *all* the unlucky customers of the St. Pancras Vestry. This, however, is not the case. Mr. Sydney Baynes, the new electrical engineer to the St Pancras Vestry, had previously satisfied himself at Bradford that a reliable 220-volt 8-cp lamp was on the market, and that ordinary careful 110-volt wiring and fittings would stand the extra strain, and the moment he was settled in his new position decided to carry out his 220-volt policy at St. Pancras. *New* customers on the *old* network will be placed across the two outers, and all *extensions* will be at 440 volts, 220 between each outer and the neutral. Conservative fitters and lamp-makers are very dubious about the suitability of 110-volt fittings and the durability of 8-cp 220-volt lamps, and rightly so. Mr. Baynes, however, relies on his Bradford experience, and in a matter of this kind the proof of the pudding is certainly in the eating.

MAGNETIC UNITS AT THE BRITISH ASSOCIATION.—The proposals of the electrical standards committee of the British Association in regard to the creation of a set of new magnetic units and names, which were brought forward by Dr. Oliver Lodge, at Ipswich, gave rise to an interesting discussion. As the substance of these proposals has already been published for some time, and is known to electricians in all parts of the world, it need not be restated now. It is gratifying to notice that the new units and nomenclature were brought forward as tentative recommendations or suggestions, which, it was hoped, might meet with the approval of electricians at home and abroad, rather than as hard and fast laws, which should admit of no re-discussion. It is to be hoped that our foreign confreres will regard the matter in this light and that there may be international unity in the attempt, which must soon be made, to put electromagnetic measurement on a sound scientific basis. It was recognized by some of the speakers who took part in the discussion that the names proposed and the magnitudes of the new units would in some instances clash with American usage; but it is to be hoped that as neither American nor British usage, in this matter, has yet crystallized, there may yet be international accommodation and agreement. One of the most striking features, as it seemed to me, of the debate which took place on these new proposals was the widespread expression of the desire for the adoption of the rational system of units proposed by Mr. Oliver Heaviside. Even those who failed to see that there remained any chance of these rational units being adopted were still regretful that they had not been introduced in the first instance. In America, where Mr. Heaviside's system has been more extensively appre

ciated and used than it has been here, this prospect of a radical revolution of the whole system of established electromagnetic units will possess no little interest. It remains to be seen whether so great a change will be attempted on any authoritative and extensive scale; and after that comes the question: Will the attempt be successful?

General News.

Electric Light and Power.

WAITSBURG, WASH.—The citizens have decided to put in an electric lighting system.

BRONSON, MICH.—The citizens will vote on the question of establishing electric lights.

MENTON, MICH.—An electric lighting plant will be put in by the Sparroll Kroll Lumber Company.

CLAY CITY, IND.—The power-house of the Clay City Electric Light Company was recently burned.

WALSENBURG, COL.—The electric light plant at this place has been destroyed by fire. Loss, $6,000.

CRETE, ILL.—The planing mill of the Crete Manufacturing Company is to put in an electric lighting plant.

ST. JOSEPH, MO.—Steps have been taken to improve the condition of both the fire department and electric lighting plant.

WASHINGTON, PA—The school board is contemplating the adoption of electrical apparatus in the new school building.

GLENOLDEN, PA.—The police and light committee and the highway committee of Glenolden recently decided to light the borough electrically.

KINGSTON, N. Y.—Adolph Eichler will erect a hotel on the corner of Broadway and Roderick Street, which will be wired for electric lights.

LA PORTE, IA.—Plans and specifications are being prepared for the erection of an electric light plant, for which bids will be received by A. Van Balkenburg, secretary.

NEW YORK CITY.—Schenk & Schlichts will erect a six story factory from plans prepared by John P. Voelker, 22-24 Jones Street. The building will be lighted by electricity.

HOBOKEN, N. J.—L. Beyer, of Hoboken, has prepared plans for the public library building, which has been accepted by the library commission. The structure will be provided with electric wiring, fixtures, etc.

BLACKSTONE, MASS.—Proposals for electric lighting the streets of Blackstone will be received by John F. Campbell. For particulars and specifications address Jeremiah Gatchell, 53 State Street, Boston, Mass.; Andrew Booth, Blackstone, or A. B. White, Millville, Mass.

OSAWATOMIE, KAN.—Sealed proposals will be received by the board of trustees of the State charitable institutions until Oct. 14, at the insane asylum, at Osawatomie, for the construction of an electric light plant for that institution. Separate proposals will be received for engines, dynamos and countershaft, or proposals will be received for the plant complete and in place. Separate proposals will also be received for wiring the buildings complete, and also for the construction of the power-house. Plans and specifications for the respective parts are on file at the office of J. C. Rollins, state architect, and at the office of J. G. Haskell, superintendent, Topeka, Kan., and also at the asylum.

The Electric Railway.

TOWANDA, PA.—Work on the Towanda & Canton Railway will be commenced next week.

AKRON, O.—A company is being organized to construct an electric line from Arkon to Massillon.

CROMWELL, CONN.—The Selectmen have granted the Middletown Electric Railway right of way through the town for its lines.

NORTH EAST, PA.—It is reported that a company with a capital of $250,000 will build a trolley road from North East to Erie.

CATSKILL, N. Y.—An electric road will be built from Catskill to Windham by the Catskill, Cairo & Windham Street Railway Company.

PITTSBURG, PA.—It is understood that the Pittsburg & Lake Erie Railway disclaims any intention of building an electric line to McKeesport.

HOLLISTON, MASS.—The Milford, Holliston & Framingham Electric Railway Company has applied for a franchise to construct an electric road.

COHOES, N. Y.—The Cohoes City Railway Company will probably extend its tracks to West Troy to connect with the Albany City Railway tracks.

NORWICH, CONN.—The directors of the street railway company have decided that the project to build an electric railway between New London and Norwich is to be abandoned.

ST. LOUIS, MO.—A survey is being made for an electric railway from Rinkleville to Ferguson, a distance of 10 miles, and it is understood that the St. Louis County Railway Company is interested.

CLEVELAND, O.—Permission has been granted the Cleveland & Elmyria Electric Railway Company by the county commissioners to construct two electric pumps under the South Rocky River Bridge.

EAST ST. LOUIS, ILL.—The citizens residing near Gross Park have signed a petition requesting the management of the East St. Louis Eelectrc Railway Company to extend the lines to that section.

OIL CITY, PA.—A charter has been granted to the Oil City Station Railway Company, John B. Smitham, president, and it is contemplated to build an electric line between Oil City and Franklin via the Deep Hollow Route.

BALTIMORE, MD.—Ground has been broken for the new power house of the Baltimore, Middle River & Sparrows Point Electric Railway on the Eastern Avenue Road. The building will be of brick and iron, 62 x 110, to cost $7,000.

JOHNSTOWN, N. Y.—John J. Nellis in behalf of the Amsterdam Street Railway Company has asked the Council for consent to build and operate an extension of the Amsterdam road from its present terminus at Akin, N. Y., into this city.

SALT LAKE CITY, UTAH.—O. B. Hardy and W. J. Moorhead have asked the county court for a franchise to build and operate electric railways in the West Mountain mining district, with headquarters at Bingham. The application was referred to the county attorney.

ST. JOSEPH, MO.—The St. Joseph Traction & Lighting Company has sold its electric light property, and the company will be reorganized with an increased capital stock. The electric railway will be improved and extended, for which $500,000 in bonds will be issued.

MONROE, MICH.—The Monroe Electric Railway Company, recently organized with a capital of $50,000, will build a road between Monroe and Dundee, 15 miles apart. F. C. Rauch, A. B. Bragdon, F. B Strong, Fred H. Humphrey and H. H. Cowles, of Monroe, are among those interested.

HAGERSTOWN, MD.—The Hagerstown & Potomac Electric Railway Company has been organized by E. E. Sponseller, of Harrisburg, Pa.; J. Clarence Lane, of Hagerstown, and Hon. G. M. Culp, of Shamokin, Pa., to build trolley lines from Hagerstown to Funkstown, Pen-Mar and Waynesboro.

LOCKPORT, N. Y.—The differences between the Lock City Electric Railway Company and the New York Central concerning the crossing at Hawley Street have been settled. The work of crossing the tracks will be at once carried forward under the direction of the engineers of the two roads.

CHICAGO, ILL.—The charter of the Chicago City Street Railway Company has been filed. The company is organized, with $5,000,000 capital stock, to build, equip and operate railway lines in and about Chicago. The directors are A. J. Hawhe, F. A. Wheeler, T. A. Kane, A. W. Atterbury and C. A Emons.

OXFORD, PA.—Col. Fell, of Wilmington, has been here for the purpose of ascertaining what encouragement would be given a company that would build an electric railway in this town and some of the neighboring towns in this section. A meeting of the Oxford Board of Trade will be held to discuss the subject.

CHAGRIN FALLS, O.—Assurance has been given the Cuyahoga Suburban Railway Company, which will construct an electric line from Cleveland to Chagrin Falls, that a franchise will be granted the company by the Village Council of Chagrin Falls, and it is stated that work will begin at once on the line. Crosby Thompson is at the head of the enterprise.

BUFFALO, N. Y.—Application has been made to the board of railway commissioners in the State of New York, by the Buffalo, Gardenville & Ebenezer Railway Company or approval of the operation of its railway by the overhead trolley system, on a route beginning at a point on Majorie Street, near Seneca, to the junction of the Union and Aurora plank roads in the town of West Seneca, Charles R. De Freest is secretary.

IRONDEQUOIT, N. Y.—The Irondequoit & Lake Shore Railway Company will construct a street surface railway from Forest Lawn in the town of Webster, Monroe County, to a point near the shore of Lake Ontario, in the town of Irondequoit The directors are: A. J. Johnson, Joseph C. Tone, Joseph A. Johnson, Frank W. Elwood and Edward S. Ellwanger, of Rochester; E. O. McNair and David W. McNair, of Warsaw.

BALTIMORE, MD.—The Baltimore county commissioners held a session last week to hear petitions asking for the granting of railway franchises in the 13th district. Applications to construct an electric railway on the Washington, Hollins' Ferry, Fishhouse and Annapolis roads have been made by the City & Suburban Company, the Columbia & Maryland Company and the Baltimore & Washington Turnpike & Tramway Company.

Miscellaneous.

THE BROOKLYN ELECTRICAL SOCIETY began its lecture course for the season of 1895-96 on Tuesday evening, Oct. 1. The lectures during the month will be held on Tuesday evenings of each week, in the Edison Assembly Rooms, No 370 Pearl Street. Information concerning the society can be had by addressing Arthur A. Fish, corresponding secretary, No. 370 Pearl Street, Brooklyn.

Trade and Industrial Notes.

E. H. CADIOT & CO., electrical engineers, formerly at 44 Rue Taibout, Paris, have removed their headquarters to 12 Rue St. Georges.

A NEW INCANDESCENT LAMP.—Frank H. Stewart & Company, of 35 North Seventh Street, Philadelphia, have recently put on the market the "Stewart Incandescent Lamp." The claim is made that the lamp is of the highest grade and has already received numerous flattering testimonials from users.

CHARLES J. MAYER, Betz Building, Philadelphia, representing the R. D. Nuttall Company in the Middle States, and also carrying a large line of railway supplies on his own account, will attend the Montreal convention in behalf of the Nuttall Company and also in his own interest. Mr. Mayer reports business very gratifying.

THE CHICAGO ELECTRIC WIRE COMPANY, of Delaware, has opened an office in the Hale Building, Philadelphia, in charge of Mr. E. T. Davis. This company has gone to a heavy expense to put in a most complete equipment of machinery for the production of high-grade rubber-covered wires, cables, etc., including 100 braiding machines alone.

GEORGE C. EWING, 620 Atlantic Avenue, Boston, manufacturer's agent for high grade electric railway supplies, through indefatigable energy coupled with an exceedingly fine list of railway specialties covering almost everything required for electric railway purposes, is rapidly gaining for himself the prominence and business recognition which he deserves.

A VERITABLE WORK OF ART, which does credit to the originator, is to be found in a pamphlet recently issued by the Ball Engine Company, of Erie, Pa. The pamphlet contains 20-odd handsome engravings showing the different types of engines which the company builds, many of them being shown direct-connected to dynamos of various makes. The typographical work is superb, both as to design and execution.

MUNICIPAL LIGHTING must be something more than a mere fad in Ohio, where no less than seven lighting plants are being constructed, the Standard arc system of electric lighting being adopted in each case. The Standard Electric Company, of Chicago, thinks that the success of the Standard system in Springfield, Ill., and in many other municipal plants as well, influenced the choice of the Ohio officials, which is quite a natural conclusion.

THE ELECTRIC APPLIANCE COMPANY, of Chicago, as general western agents for the Grutting electric heating appliances, is calling attention to the good points of the Grutting electric soldering iron, and an electric curling iron heater. The Appliance Company has published some pithy circulars descriptive of these goods, going considerably into detail, which are exceedingly interesting to those using or expecting to use devices of this class.

BURNED OUT.—The Horn & Brannen Company's factory, at Broad and Willow Streets, Philadelphia, was destroyed by fire on Tuesday night of last week. The loss on buildings, stock and machinery is estimated at $175,000. The company has the sympathy of THE ELECTRICAL WORLD and the trade at large, and it is to be hoped that this energetic concern will rebuild and continue the manufacture of the artistic fixtures which have served to make its name familiar and its salesmen welcome all along the line.

STRUCTURAL IRON WORK is constantly increasing in favor with electric light and railway companies. The Berlin Iron Bridge Company, of East Berlin, Conn., has just completed a new car house for the Norwalk Tramway Company, at South Norwalk, Conn., and a new generator house for the Burlington Gas Light Company, at Burlington, Vt. Scarcely a week passes that this company does not close one or more contracts for work of this character. The company reports business just now as exceedingly brisk in all its departments.

INVERTED ARC LAMPS.—The Electric Appliance Company, of Chicago, has something interesting to say about its new system of interior lighting by means of the inverted Upton arc lamp, by which the light is thrown against a white ceiling, and thus diffused more evenly than is possible in any other way. This arrangement entirely does away with sharp shadows and darkness in spots, and gives the nearest approach to sunlight that has yet been secured. It is particularly adapted to large stores, mills and factories, and promises to come into quite general use.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, of St. Louis, Mo., is distributing a new catalogue of electrical specialties. Besides the Weston fan motors, which have made friends for the company throughout the entire country, this progressive concern is making arc light transformers, fuse blocks, distribution panels, knife switches, stage regulators and a number of other special contrivances; it is these that are described in the new catalogue. A particular feature to which the company calls attention is its possession of excellent facilities for the manufacturing in quantity of any special devices or apparatus which may be desired.

MR. J. D. McINTYRE, for six years traveling representative of the Electric Engineering & Supply Company, of Syracuse, N. Y., but now with Pass & Seymour, of the same city, is making his first trip for his new employers. In Chicago last Thursday he spoke enthusiastically of the revival of business in the West, and said the orders he was receiving indicated unmistakably a hopeful feeling on the part of jobbers and dealers in the electrical line. Mr. McIntyre says that the demand for the Pass & Seymour porcelain specialties both in the East and in the West is steadily increasing. He has a host of friends throughout the trade all over the country, and will prove a valuable acquisition for his new firm.

A PACK OF CARDS was regarded, in the time of Miles Standish, as an instrument of his Satanic majesty, but matters have changed since then, and it is safe to assume that the artistically decorated packs which are being distributed by A. L. Ide & Son, Springfield, Ill., will be thoroughly appreciated by those who are fortunate enough to receive them and that many an enjoyable game of po— whist will be the result of this enterprising firm's new conceit in the advertising line. The cards are handsomely illustrated on the backs with pictures of Ideal engines. Messrs. Ide & Son have been prolific in neat and original advertisements, and if the number of Ideal engines now in use and the rate at which this firm's business is increasing be taken as a criterion, these clever efforts have undoubtedly reaped the reward they deserved.

THE FERRACUTE MACHINE COMPANY, of Bridgeton, N. J., is very busy, the works running evenings in order to keep up with the crowd of orders. The company has recently shipped two large double-crank presses to the General Electric Company, making seven of these heavy presses that have been furnished the General Electric, all of which are reported as being eminently satisfactory. One of these presses was sent to the branch factory in Germany, and the other six are being used in Schenectady. The largest of these presses is capable of cutting a blank of sheet metal four feet wide and eight feet long, and is used in making the largest size armature discs. The smallest will cut a circular blank about two feet in diameter. The presses weigh from 15,000 to 20,000 pounds each, and the last two for extra heavy work were built with columns made of steel castings instead of iron.

THE PENNSYLVANIA ELECTRICAL ENGINEERING COMPANY, of Philadelphia, has secured a large contract for wiring the new 12-story building of the Fidelity Mutual Life Association at Philadelphia, Pa. Iron-armored conduit is to be used throughout, and the work is being vigorously pushed. This will be the largest non-armored conduit installation in Philadelphia. Approximately eight miles of conduit will be used. The Pennsylvania Electrical Engineering Company has also secured the contract for wiring the new building of the University of Vermont. The staff of this energetic company is as follows: President, J. P. Gaylord; treasurer and general manager, Lewis R. Shultz; electrical engineer and superintendent, Elias Nusbaum; architect, J. Harris Reid, formerly with Wilson Brothers; mechanical and steam engineer, A. E. Wright, formerly of the Smith Woolen Machinery Company, and also with Coutsville Boiler Works.

Business Notices.

ELECTRIC LEAGUE.—Meets every Thursday evening, 100 West 24th Street, New York. Electrical engineers and electricians cordially invited.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 15 South Warren Street, Syracuse, N. Y.

THE SETH THOMAS CLOCK COMPANY, of Thomaston, Conn., has for a number of years done a great deal of work for electrical companies, and would be glad to increase this line of business. They will make estimates for any article akin to clockwork, for which a model is furnished and which is wanted in quantities. Address, Seth Thomas Clock Co., 49 Maiden Lane, New York.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED OCT. 1, 1895.

(In charge of Wm. A. Rosenbaum, 177 Times Building, New York City.)

546,906. ARMATURE FOR ELECTRIC MOTORS AND DYNAMO-ELECTRIC MACHINES; H. Chitty, London, Eng. App. filed July 26, 1892. The combination of a dynamo having poles arranged in a circle and an armature concentric therewith having equally disposed in it as many groups of sections of winding as there are magnetic poles, and also two windings in opposite directions in each section.

547,031. CONTACT FOR ELECTRICALLY PROPELLED VEHICLES; E. B. W. Reichel, Charlottenburg, Germany. App. filed April 4, 1894. A contact consisting of a horizontal arm composed of anti-friction material extending transversely to the trolley conductor and adapted to make contact.

547,034. App. filed April 15, 1895; 547,035. App. filed April 15, 1895; ELECTRICAL INDICATING MECHANISM; F. J. Russell, New York, N. Y. An electric circuit having two branches, in one an electromagnet and a lamp, and in the other a circuit closer controlled by the said magnet; also an indicating device actuated by the circuit closer; a bell and lamps disposed in proximity to the indicating device.

547,043. RECTIFIER FOR ELECTRICAL CURRENTS; W. J. Still, Toronto, Canada. App. filed Dec. 24, 1894. The combination of a shaft driven so that it will have a tendency to revolve slightly in excess as to number of commutations of the number of alternations of the current in the same time, and a commutator suitably formed and secured to the common shaft connected by brushes to the alternating-current wires and co-acting brushes to lead off the continuous current and mechanism whereby the commutations are varyingly retarded at all periods into unison with the alternations of the current, so that the continuous cycle of undulations is practically cut at the zero points.

547,069. ROTARY FIELD MOTOR; J. H. F. Gorges, Berlin, Germany. App. filed Oct. 10, 1893. The combination of two ring members placed face to face and having pluriphase windings to produce a rotating magnet field in the space between the ring members, and a rotatable member situated in the space between the ring members adapted to be rotated by the field.

547,071. App. filed Feb. 23, 1894; 557,072, filed Feb. 23, 1894. ELECTRIC DEVICE FOR CONTROLLING ACTIONS OF MUSICAL INSTRUMENTS; F. W. Hedgeland, Chicago, Ill. The combination of a perforated strip of circuit closers, having studs adapted to enter the holes, and also adapted to be lifted out again by the movement of the strip, and suitable guides for holding and confining the strip at the point where it passes the stud.

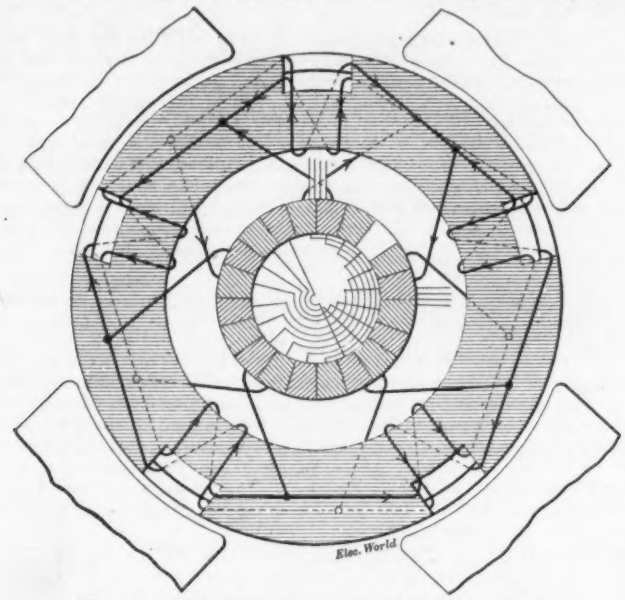
547,078. ELECTRICAL JUNCTION BOX; W. S. Johnson, Milwaukee, Wis. App. filed Jan. 21, 1895. The combination of a box, a soft rubber partition dividing it into two compartments, electric conductors passing through and provided on opposite sides with suitable electric connections.

547,106. HANGER BOARD FOR ELECTRIC ARC LAMPS; T. E. Adams, Cleveland, Ohio. App. filed July 17, 1895. The combination of a base plate and a lever pivotally mounted thereon connecting together, switch devices also mounted thereon; a yoke for the lever, a lip on the lever, and a shoulder at the upper end of the yoke to receive the lip and retain the lever elevated.

547,120. INSULATING COMPOUND; S. Heimann, New York, N. Y. App. filed Feb. 28, 1895. A compound composed of various substances which when formed into a mixture acts as a perfect insulator.

547,127. ELECTRIC ARC LAMP; J. W. T. Olan, New York, N. Y. App. filed April 8, 1893. The combination of an electric lamp provided with liquid electrodes within an exhausted enclosure, and means for automatically maintaining continuous circulation of the liquid within the lamp.

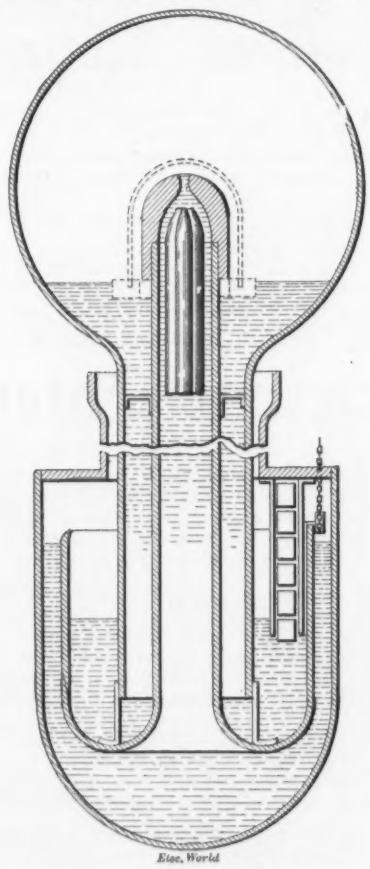
547,149. ELECTRIC SWITCHES; N. Marshall, Boston, Mass. App. filed June 8, 1895. The combination of a base provided with suitable contacts, and a fixed ratchet, a spindle, journaled therein having an arm; a switch bar also loosely mounted on the spindle; a pawl located between the ratchet and the switch bar and having a hinged connection with the latter, and capable of a swinging movement, and a spring between the spindle and pawl.



No. 546,996.—Dynamo or Motor Armature.

547,230. AUTOMATIC ELECTRIC SWITCH; G. W. Russell, Jr., and A. V. Officer, Denver, Col. App. filed March 18, 1895. A switch and means for cutting out the solenoids after they have been momentarily energized by a pair of brushes arranged at the outer end of each solenoid, the reciprocating bar being so constructed that it is adapted to pass between the brushes and close the circuit of the opposite solenoid

547,240. ELECTRICAL SAFETY APPARATUS FOR RAILWAYS; L. W. Briggs, Chicago, Ill. App. filed Aug. 23, 1893. A device for automatically



No. 547,127.—Arc Lamp.

arresting the movement and bringing a train to a stop whenever it enters upon a section of the road at the same time as another train.

547,246. MAST ARM FOR ELECTRIC LAMPS; J. J. Drake, Providence, R. I. App. filed Feb. 21, 1895. The combination of a mast and suitable arm secured thereto pivotally, and a carriage within the tubular arm carrying a cable and supporting a lamp.

547,249. INCANDESCENT LAMP; H. Green, Hartford, Conn. App. filed Jan. 25, 1895. The combination of a socket having circuit terminals, a circuit of bearing faces for engaging a lamp-bulb and preventing longitudinal movement, while permitting relative rotation; a removable bulb having an annular holding ember co-operating with the bearing faces.

547,265. TELEPHONE; H. T. Johnson, Elizabeth, N. J. App. filed June 18, 1894. The combination of a call bell and a telephone in normally closed parallel circuits, a magnet in a branch of the bell circuit, and a switch for making and breaking the telephone circuit and at the same time closing the circuit through the bell and magnet.

547,283. TROLLEY AND TROLLEY POLE; W. L. Pepper, Philadelphia, Pa. App. filed Dec. 29, 1894. A trolley pole consisting of telescoping sections, rods pivoted thereto, pivoted levers to the rods, and means for tilting the said levers to cause the upper section to be extended.

547,300. RAILWAY CAR LAMP; C. G. Smith, Brooklyn, N. Y. App. filed Aug. 11, 1894. A device consisting of a sliding joint having a screw-threaded upper portion fixed in the ceiling of a car, and holding the bulbs firmly in the removable lower portion combined with suitable means whereby the bulbs may not feel concussion.

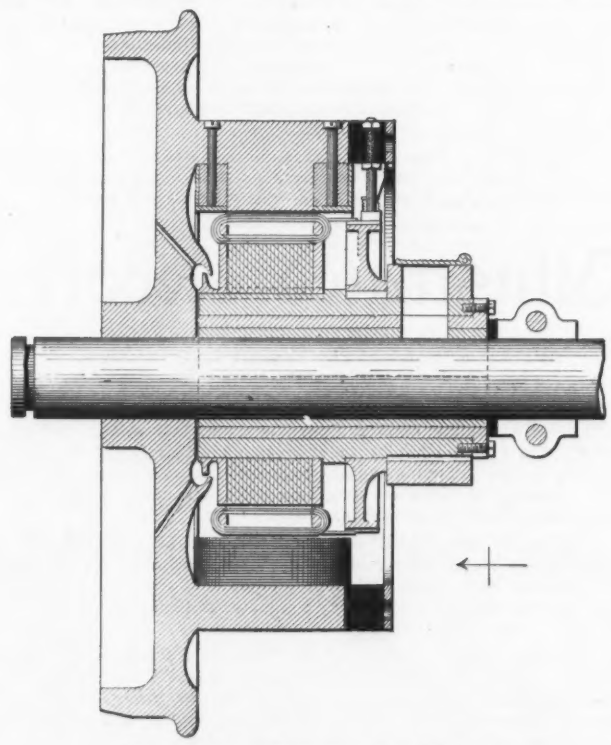
547,304. CONDUIT SUPPLY SYSTEM FOR ELECTRIC RAILWAYS; G. Tolmie, Carbon, Wyo. App. filed July 10, 1894. The combination of metallic projections supported out of contact, a collapsible moisture-proof case therefor, a weighted lever attached to the casing, and a collector adapted to engage the projection on a lever and depress it, thus establishing contact between the points within the case.

547,323. ELECTRIC MOTOR; A. E. Boggs and F. J. Cleaver, Beltzhoover, Penn. App. filed Jan. 4, 1895. The combination of a wheel and axle having a field magnet secured thereon, an armature mounted upon the axle, a commutator mounted upon the boss of the armature, and an insulator ring upon which are placed commutator bars; an insulated ring secured to the pole-pieces of the field magnet, inwardly extending studs secured to the insulated ring and carrying brushes, and metallic rings secured to the face of the insulated ring and connected with the said studs.

547,358. ELECTRIC SYNCHRONIZER FOR CLOCKS; H. S. Prentiss, Elizabeth, N. J. App. filed Aug. 10, 1892. In combination with a secondary clock, a notched disc secured to one of the arbors of the train, and a detent adapted to engage with the same, and an electromagnet for operating the same, and a master clock governing the movements of the secondary.

547,369. DEVICE FOR CONTROLLING SPEED OF ELECTRIC CARS; J. Brady, Brooklyn, N. Y. App. filed June 24, 1895. The combination of a governor geared to the motor, a movable contact controlled by the governor and adapted to automatically cut out the motor; means for regulating the action of the movable contact, and an indicator connected to the regulating device for indicating the speed at which the motor will be cut out.

547,383. RECIPROCATING ELECTRIC ENGINE; F. B. Rae, Detroit, Mich. App. filed May 31, 1892. The combination of an electromagnet having a continuous iron core provided with a plurality of sets of coils contained in the different conductors of the circuit of a multiphase generator, a plunger for said electromagnet and a reversing switch operated by said plunger.



No. 547,323.—Electric Car Motor.

547,388. TELEPHONE EXCHANGE SYSTEM; E. E. Yaxley and J. H. Riley, Chicago, Ill. App. filed Jan. 14, 1895. The combination of suitable independent circuits for the subscribers and central stations; a series of annunciators, switches and bushings in the central station connected with the subscribers' circuits, a general connecting strip having connection with the circuits and with the returns; a secondary connecting strip connected to the central station, and means for connecting the same with any of the series of subscribers' bushings; the talking and call circuits of the subscribers' stations, being capable of simultaneous and independent use.